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Vol. V. NEW YORK, FEB. 7, 1885. No. 6.

Handsomely bound volumes of THE ELECTRICAL WORLD *for* 1884 *are now ready, and will be sent, charges prepaid, to any address on receipt of* $5.00.

"TELEPHONE" has once more been held to mean "telegraph." The courts in Pennsylvania have decided that the Pennsylvania Telephone Company must pay $345.04 under the law imposing a tax on the gross receipts of "every telegraph company" incorporated under the laws of the State, or any other State, and doing business in the Commonwealth.

FEW men have been more prominently connected with the telegraph business during the last twenty-five years than Mr. Luther G. Tillotson, who died last week, and of whom we publish a full biographical sketch on the next page. His honorable and successful career makes him an exemplar to the fraternity of which, in earlier, youthful years, he was so active a member, and in which he took the warmest interest down to the hour of his death.

JUST as the legislators of New York are coming to the conclusion that the underground wire law passed last year will have to be modified, the mania for burying wires has struck Missouri, and a bill has been introduced in the lower house of the Legislature of that State requiring that telegraph and telephone wires shall be laid underground in all first-class cities of the State. By the way, are there any "first-class cities" in Missouri? Some detractors deny it.

TO COMMUNICATE telegraphically with a moving train, often suggested and attempted, has, it would appear, been successfully accomplished at last. A test last week, on one of the railroads running out of this city, of the system of Mr. Lucius J. Phelps showed the invention capable of maintaining communication between train and station without difficulty. The apparatus employed operates on the inductive principle, and is said to be simple in detail. A company, backed by well-known capitalists, has been formed to introduce the invention.

FROM Kansas City come the annual reports of the Missouri & Kansas Telephone Company and the United Telephone Company, both under the same management. The former shows an increase of about 26 per cent. in the number of subscribers, and of about 66 per cent. in net earnings. Mr. Geo. L. Phillips, the president, is of opinion that the company has been unequaled in its growth during the past year by any other company in the United States. The United gained also, but, owing to business depression, had to close one or two of its smaller exchanges.

THERE is still considerable opposition among business men to postal telegraphs or telephones. The question came up at the annual meeting of the National Board of Trade in Washington last week, and was warmly discussed. A resolution favoring governmental control was carried, but not by a large majority, and with the understanding that the purchase of existing lines was not covered by it. The country is not ready yet to spend between two and three hundred million dollars in buying up vested interests, and it shrinks from providing a new field of jobbery and corruption.

AN agitation has been worked up in this city against the charge of $1 made by the Western Union Company for giving notification to individuals of the sighting of foreign mail steamers and other steamers off New York. It is urged that the intelligence should be bulletined at the General Post-Office. The charge made is a very heavy one, and admitting that some one must pay for the maintenance of the sighting stations—Fire Island, Highlands, Sandy Hook and Quarantine—it is reasonable to estimate that at the rate of fifty cents four times as many notifications would be paid for. We have personal knowledge of many instances in which persons have gone without this early intimation rather than submit to what they considered a gross extortion.

PATENT COMMISSIONER BUTTERWORTH argues from the development of the telephone business that the multiplication of inventions has increased instead of reduced the demand for labor. How could the result be otherwise? As far as our reading and experience go, every time an invention has been introduced adding to the comfort and convenience of mankind, simplifying methods of communication and cheapening processes of manufacture or commerce, it has at last provided occupation for more heads and hands than were employed before. If this were not so, the state of barbarism, in which human wants are fewest and are met by direct personal supply, would be that in which labor found its highest remuneration and its briskest demand.

REVOLVERS have been discarded for district call boxes by the Chinese laundrymen of Newark, N. J. Several burglarious raids have been made recently on the poor Celestials, sometimes as many as six in a week, and in sheer desperation the victims took to revolvers. This remedy was not very successful, as the average Chinaman is not a good shot, and the necessary target practice also rendered him obnoxious to the neighborhood. Then other means of protection were discussed, and the outcome is that thirty-two boxes have been put into laundries by the Municipal District Telegraph Company. In spite of the ingenious explanations to them of Mr. Newberry, the vice-president of the company, the Chinese patrons of the boxes still believe that the service is operated by some supernatural agency.

MANY are the stories as to the uses and devices by means of which impostors, ancient and modern, claiming the possession of supernatural powers, have awed their dupes; but it is only now that the telephone has been employed to practice on the credulity of stupid and ignorant devotees. It is reported from Tunis that a French priest who has become a Mussulman, is posing as one of the holiest of men and enjoying great renown among the Arabs for wisdom. He is installed at Kairwan, in a kouba or shrine, which derives considerable revenue from the gifts of reverent admirers. In order to increase his fame and income, he has now put up a telephone, by means of which the inquiries of pilgrims are conveyed to him by the attendant and his oracular answers are given forth. The wonder of the Arabs is like that of the Chinamen in Newark over their new district call boxes.

CABLES have been unlucky of late. The latest to snap is that of the Direct United States Company, and the mishap is contradictorily said to have occurred "300 miles east of Nova Scotia" and "about 400 miles west of Ireland." We believe that that makes the fourth "pool" cable rendered useless, leaving the Anglo-American and the Commercial to do the business. It would be interesting to know what were the causes of these breakages. They have been attributed to earthquake, but without proof. The sooner the bottom of the Atlantic Ocean is thoroughly surveyed and mapped out the better it will be for the cable companies. There is still too much guesswork in connection with the few soundings taken. Early repairs of the disabled cables are promised. It is said the French cable is already patched up.

A MEETING of electric light people in Chicago was held on the evening of Feb. 4 at the Grand Pacific Hotel to take the initiative with regard to the "electric light convention," about which there has been some little talk lately. All the companies in business locally were represented except the Edison, and the present indications are that all will participate except that company and the Brush, although these may come in later. The meeting was presided over by Mr. C. A. Brown, of the Western Electric Company, and officers and committees were appointed. It is proposed to hold the convention at the Grand Pacific on the 25th inst., and meantime circulars will be issued and arrangements made. Naturally, the transmission of power must be considered as well as lighting, if the convention is held and is to do anything like practical, beneficial work.

IT is a significant commentary upon the reduction in the price of gas here that a permanent organization has at once been formed, called the "Gas Consumers' Association of the State of New York." Gas bills have been much heavier since the reduction than they were before, and to this general experience of consumers is added the peculiar case of one well-known gentleman who closed his house for two months and then found his bills coming in just the same and as extravagantly high as ever. It was shown that on a total capital of $21,878,000, the six companies existing in New York in 1883 paid dividends amounting to $3,008,000, and added $712,988 to surplus account. The best thing for these aggrieved consumers to do is to go into the electric lighting business and supply themselves. If they will look into the subject, they will find that, light for light, and other advantages considered, electricity is cheaper than gas.

IN a new French battery, a rod of amalgamated zinc forms the positive, and several rods of carbon the negative pole, the liquid being a weak acid or basic solution, such as that of sulphuric acid, of a bisulphate or acid sulphate, of hydrochlorate of ammonia, or of sea salt. The carbon is said to be so modified all through its substance during manufacture that hydrogen cannot accumulate on its surface; but the gas is obliged to pass off as generated, thus avoiding polarization. This new battery, the E. M. F. of which is 1.15 volt, is claimed to be capable of working for an almost indefinite period, so long as the liquid lasts, to occupy little space, to be of easy management, and to be cheap, both in first cost and in maintenance. It has, however, a high internal resistance when required to give out a large quantity of current, as in the case of electric lighting. This is attributed by the inventors to the fact that the hydrogen, on being disengaged, in raising up the carbons forms a layer of gas which opposes the current. They hope, however, to be able in time to counteract this disadvantageous action.

WE give elsewhere to-day some of the constitutional objections raised in Canada against the decision of the Minister of Agriculture, rendering the Bell patent null and void. Although the decision is "without appeal," it seems that the Court of Appeal will be asked to pass upon his right to settle the case, and that the constitutionality of his powers under the Patent act will be challenged. It is stated also that the actions in court will still go on, as the Bell Company are suing the Dominion Telephone Company, of Montreal, for infringing not only the Bell receiver, but the Edison, Blake, Anders and Phelps patents on transmitters and receivers, and the Toronto Telephone Manufacturing Company is being sued on one transmitter and three receiver patents. Writs have also been issued by the Bell Company against the Port Arthur Telephone Company and against J. F. Ruttan and other subscribers to the exchange of that company. Some of these cases will come up at the Spring sitting of the Court of Chancery in Toronto. The Bell Telephone Company of Canada has pretty well covered the territory, comprising the whole of the country, and has been doing a comfortable business. It is not heavily capitalized—only $1,000,000. Of this the American Bell holds something over half. The business has been paying 7 per cent., and it would thus appear that, if necessary, the Bell people can put down prices very low. But could the opposition do much, for instance, at Toronto where there are 1,000 Bell subscribers and the rate is only $50?

REVIEWS OF NEW BOOKS.

STATIONARY STEAM ENGINES, ESPECIALLY AS ADAPTED TO ELECTRIC LIGHTING PURPOSES. By Prof. R. H. Thurston. New York: 1884. John Wiley & Sons. $2.00.

Electric lighting, more than any other cause, may be said to have given steam-engine building the impetus which, especially in this country, has resulted in the construction of engines of a high degree of speed and efficiency, and possessing features of value not only for lighting, but for other purposes as well. Not that engines of high economy and close regulating powers did not exist before the advent of electric lighting, for such an assertion would be erroneous, but with the introduction of the latter method of illumination a certain class of steam-engines, viz., the high-speed, found a field eminently adapted to their powers, and their development followed in consequence. Electric lighting, in which high rotative speed of armature and close regulation play most important parts, calls for peculiar conditions of working, and its demands have been met by numerous engineers in various ways. In describing these later forms, together with the older ones of established reputation, the author presents the most modern as well as the best practice in steam-engine building. The book is a reprint of a series of articles which appeared in the *Electrician*, of this city, and is a valuable record of progress in a most important industry. The work is copiously illustrated, and cannot fail to prove a valuable addition to a professional as well as a non-professional library.

The Woodhouse & Rawson Lamps at the Vienna Exhibition.

The following is an extract from the report of the jurors at the Vienna Electrical Exhibition, and gives the results obtained with the Woodhouse & Rawson incandescent lamps.

In the first tabulated statement it will be seen that the lamps, even when run far below their normal candle-power, have an exceedingly high efficiency. For instance, it will be seen that whereas a 20 candle-power lamp has an efficiency of about 2½ watts, when it is running at about 12 candle-power, it has an efficiency of 3.13 watts per candle-power, about equal to the Swan lamp; and when running at about 8 or 9 candle-power, an efficiency of about 3.77 watts per candle-power, equal to the Edison lamps. Of course, when the lamps are under run in this way the length of life should be very considerable.

The second statement gives the average efficiency of the total number of lamps tested, namely, 2.38 watts per candle-power, or 312 candles per horse-power:

Normal C. P.	Observed C. P.	Current in ampères.	Difference of potential in volts.	Resistance hot in ohms.	Watts absorbed.	Watts per C. P.	No. of normal candles per electric H. P.
20	4.64	0.779	35.24	45.26	27.44	5.91	122
	6.85	0.838	37.65	44.95	31.54	4.60	160
	8.98	0.869	38.92	44.80	33.81	3.77	196
	10.85	0.905	40.35	44.59	36.51	3.37	219
	12.18	0.926	41.21	44.52	38.14	3.13	235
	15.58	0.966	42.83	44.34	41.38	2.66	277
	20.32	1.018	44.88	44.10	45.67	2.55	327
	26.27	1.071	46.92	43.79	50.27	1.91	385
	34.24	1.126	48.93	43.44	55.11	1.61	456
	45.81	1.193	51.25	42.95	61.16	1.34	515
Average of total number of lamps tested:							
20	20.78	10.72	46.26	43.71	49.38	2.38	312

Death of Mr. L. G. Tillotson.

We regret to announce the death of Luther G. Tillotson, on Jan. 31, from Bright's disease, at his residence, 19 East Forty-ninth street, this city.

Mr. Tillotson, the head of the well-known firm of L. G. Tillotson & Co., 5 and 7 Dey street, was born at Ithaca, N. Y., March 1, 1834. He received there an ordinary English education, and was about fifteen years of age when his future was determined by the action of his father, Daniel T. Tillotson, in moving West to become secretary and superintendent of the Erie & Michigan Telegraph Company. Mr. James D. Reid, in his standard work, "The Telegraph in America," says: "On Feb. 10, 1849, L. G. Tillotson commenced his life's work by copying his father's official letters." Having learned telegraphy on the lines of the Erie & Michigan Company—afterwards the Western Union Company—young Tillotson returned to the East and entered the telegraph service of the Erie Railway Company. His abilities and experience soon won recognition, and at the early age of nineteen he became superintendent of that department. He occupied the position for several years with marked credit, adding to his duties on the road those of a division superintendent of the Western Union Telegraph Company.

Meantime the growth of the telegraph business created an immense demand for telegraph supplies, and Mr. Tillotson was quick to see the opportunities presented to him by his acquaintance with practical telegraphy, and his intimacy with many of the leading men in the craft. In 1862 he therefore began business in this city as a merchant in railway and telegraph supplies, under the firm name of Tillotson & Co. The business grew and prospered, and on Nov. 1, 1865, the present house of L. G. Tillotson was established, Mr. Tillotson's partners being Gen. E. S Greeley and Mr. W. H. Holt. To this business the deceased gave his whole time and attention, caring little to go outside of it either in the pursuit of wealth or of public honors. He might at one time have become identified with telephone interests, but preferred to have nothing to do with them. He, however, became connected with the American District Telegraph Company as a director, and his name will be remembered as appearing frequently in print at the time of the sensation over the Cornell "blind pool" in that stock. Without going into the facts of the long controversy, it may be said here that Mr. Tillotson, who had been a life-long friend of Governor Cornell, made very serious charges against him, and resigned his position as director. It is not unlikely that this episode only strengthened Mr. Tillotson in the resolve to restrict himself to his immediate business interests, in the development of which his efforts were to the last attended with marked success. Starting with the intention of furnishing telegraphic supplies chiefly, he kept up with the later outgrowths of electrical application, and manufactured and dealt in almost everything required by the numerous electrical industries of to-day.

Mr. Tillotson took a warm interest in the movement started in 1870 to present to Professor Morse a testimonial that should fitly represent the esteem in which the Father of Telegraphy was held by operators and Americans generally. He was among the first to propose that the subscription should become national. Later, when the statue of Morse was unveiled in Central Park, on June 10, 1871, Mr. Tillotson chartered, at his own expense, the steamer "James Fisk, Jr.," and invited the delegates and their friends to participate in an excursion down the Hudson. About a thousand persons accepted the invitation, and Mr. Tillotson sought, regardless of

Yours Truly
L. G. Tillotson

expense, to make the outing enjoyable. It may be mentioned that the cost of the trip was about $2,000.

In commercial circles Mr. Tillotson bore the reputation of a careful, shrewd man. Always firm in insisting upon his due, he was not slow to generous action when occasion arose, while his advice was frequently sought by, and never refused to, those who could claim to be his friends. It deserves to be recorded that, conversing about a year ago with Mr. James D. Reid, he expressed considerable concern for the welfare of the telegraphic fraternity, and expressed his desire to spend some portion of his large fortune in aiding or endowing some fund or institution for the benefit of the craft. We are not aware, however, that the thought then uttered has been carried out.

The portrait given herewith is reproduced from the book named above, and will be recognized as highly faithful.

Mr. Tillotson married, in December, 1857, Miss Emma A. Glenn, a granddaughter of William H. Pinkney. His only child died in infancy; his wife and mother survive him. At the time of his death he was a vestryman of the Church of the Heavenly Rest, where the funeral service was held on Tuesday, the 3d inst., at 10 A. M.

Solar Energy vs. Coal for the Production of Electricity.

BY C. E. FRITTS.

I noticed in the newspapers of Sunday, Jan. 18, an article from Mr. Edison and quoted by THE ELECTRICAL WORLD, on Progress in Electricity, which contains several statements that practical electricians and inventors may question. I will only notice the one which concerns myself. He says that the idea of certain French and German scientists that electricity can be produced directly from solar energy is a chimera, or at least remote and untrustworthy.

Mr. Edison must have written very hurriedly, for all intelligent electricians know that electricity "can be" so produced, on the authority of scientists whose reputation for ability and veracity cannot be shaken by Mr. Edison or any other interested opponent of that plan. The fact that Mr. Edison once made a faint attempt to enter this field of research, and failed to gain even a foothold, does not justify him in pronouncing the idea a chimera, for it is generally held that those who fail are not the proper ones to pronounce judgment.

I have worked in that field for several years, and have obtained results which, I believe, are by far the best yet reached, being that I could get a current equal to that of one cell of the ordinary Leclanché battery, from a plate having 108 square inches (9 × 12) of surface, exposed to sunlight between 10 A. M. and 5 P. M., in August, 1884, in this city. I do not claim that this represented the total amount of the solar energy acting upon the plate; but it may fairly be called satisfactory progress, and justifies the hope that much better results may yet be reached, if not the entire conversion of solar energy into electrical energy.

These plates can be mounted in frames, like panes of glass in a window sash, and we get a current corresponding to the number of plates connected together. They can be used in or out of doors, on roofs, walls, or wherever light is available. Current is produced not only by sunlight, but also by diffused daylight, moonlight, and even by artificial light. It is as if a mirror, instead of reflecting back the light which falls upon it, as light, should give it out in the form of a current of electricity, being no more changed by the process than a mirror is by use. The device is a solid metallic plate, protected by a glass in front, and properly insulated in any convenient way. In *compactness*, this system could not compete with a steam engine and dynamo, but, when we consider that these plates require no more care or attention than to keep so many windows clean enough for the light to shine through them, that they are always ready for use, and are unchanged by action, so that there is no material used up (except light, if we call that our "material,") and, therefore, no running expenses to pay, it will be admitted, by candid thinkers, that the idea cannot be properly termed either a chimera or remote and untrustworthy, and that in a great number of cases it would be vastly preferable to the engineer-and-dynamo system, since every house could produce its own electricity. As soon as my rights are properly secured by patents, so that it will be safe to show the apparatus publicly, I shall be happy to afford Mr. Edison an opportunity to post up on this subject.

As I communicated my methods and results to Dr. Werner Siemens, confidentially, nearly a year ago (February 29, 1884), it is probable that some of the "French and German scientists" to whom Mr. Edison alludes based their statements upon my discoveries, or upon results obtained by Dr. Siemens in testing my system. As for the others, I leave them to make such reply to his strictures as they think fit, if they think it worth while to make any at all.

Since Mr. Edison pronounced my idea a chimera, let us look at his and see what that amounts to. He thinks that a practical method of producing electricity directly from coal would work an electrical and industrial revolution. Now, so far as merely utilizing the whole of the energy of the coal is concerned, if accomplished by the present system, it would be a comparatively small matter. In a well managed company the cost of the coal consumed may be put at about 10 per cent. of the entire expense account. Even if that item could be reduced one-half, three-fourths, or entirely done away with, it would hardly make or break the weakest electric light company in existence. The "revolution" would require the abolishing of the steam engines and dynamos entirely, the substitution of a much cheaper plant, and the production of the electricity by it at a small fraction of the present cost.

Let us suppose that Mr. Edison had discovered a satisfactory method of producing electricity directly from coal; that, instead of realizing one-twelfth of the theoretical energy of the coal, as at present, he gets the entire energy of the coal in current, without any loss or deduction whatever; and that his apparatus has been used for some years, and been worked into practical and successful form, how will it then compare with the present system? Having worked at this problem myself, I have something more than a theoretical knowledge of it.

In the first place, the apparatus will be practically nothing more nor less than *a form of voltaic battery*, in which carbon is consumed instead of zinc, and the current is due to chemical action. It must therefore be discussed *as a battery*. Let any electrician who knows practically what batteries are, imagine, if he can, the space which would be occupied by enough of these batteries to furnish current in place of an ordinary 500 horse-power engine and plant, even on the supposition that its action is ten-fold more energetic than that of any battery ever yet known. And let any electrical engineer say which system would be the safer and easier to manage, and the more trustworthy in practical work. Steam is one of the easiest forms of power to confine and manage, while electricity is the most difficult. And the more energetic the action in the battery, the more difficult to manage it will become.

As *a battery*, it would require a greater number of attendants, and those of a higher grade, to operate it with success or even with safety, than the present system. It is possible, but by no means probable, that the cost of the plant required for using coal in this way would be less than for the present system. The cost of the coal itself would be a minor consideration in either case. Making every reasonable allowance in its favor, it would be more than

questionable whether the new method would prove as safe, as manageable, as reliable, as efficient, as economical, or as desirable in any respect as the steam or gas engine and the dynamo. If the electric lighting and power companies do not meet any worse trouble than the production of electricity directly from coal, I think they may rest assured that their plant will be available for many a long year to come.

The idea looks enticing, because coal is cheap. But even if zinc gave out the same amount of energy and were as cheap as coal, voltaic batteries would be practically inferior to the dynamo. I do not call the idea a chimera, because that is neither a scientific nor a politic way to treat inventions and inventors. But certainly, when examined in the light of experience and reason, its revolutionizing powers dwindle down to a very fine point. As a new form of voltaic battery it would be scientifically interesting, and it would have its place and its value. But, for a "revolutionizer," I would prefer to pin my faith to direct solar energy, and let Mr. Edison have the coal battery.

The Distribution of Electrical Energy by Secondary Generators.

The problem of the distribution of electrical energy may at present be said to be one of the most important in the field of applied electricity. The combined energy of a large number of workers and the varied ingenuity displayed in the construction of the dynamo have brought the latter to a high state of perfection, and it is questionable whether the near future will see any noteworthy changes in its efficiency. Even now there are dynamos which, as shown by actual test, convert into electrical energy more than 90 per cent. of the power applied to them.

Any changes which may, therefore, be made will tend toward the simplification of mechanical details. The economical generation of electricity being thus established, its economical *distribution* now occupies a most prominent position, as upon it obviously depends the practicability of

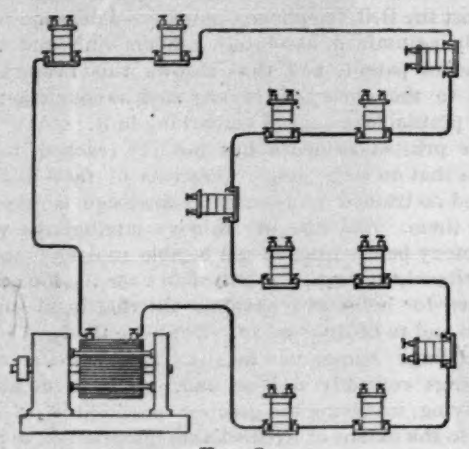


FIG. 3.

supplying electrical energy for all purposes from central stations.

It must be apparent that if, in order to supply consumers with electricity, a copper conductor is required, the cost of which necessitates the charging of high rates in order to make the investment a paying one for the company, the result must be that consumers will return to older and cheaper methods for the supply of their wants. To remove this obstacle and thus reduce the size and consequent cost of conductors has been attempted in various ways, among which may be mentioned the three-wire system, devised by Mr. Edison. In this, by employing three wires of reduced section in the place of two, as heretofore, and by a peculiar grouping of lamps, a saving of 62½ per cent. in the cost of conductor is effected.

While this is a step in the right direction, as regards the distribution of currents for incandescent lighting, it is nevertheless restricted to this particular field and does not solve the problem of general distribution of electrical energy for all purposes, including arc and incandescent lighting, as well as power. It will be seen that a system which will accomplish these objects in a convenient and economical manner from a *single* source of energy must possess many advantages, and it was this fact that led to the efforts described below.

The object of Messrs. Gaulard & Gibbs' system is to supply currents of any character and suited to any purpose to which they may be applied; and the methods employed must be conceded to be highly ingenious. They accomplish their end by means of a current generated by a dynamo at a central station; thence it is passed through so-called "secondary generators," which modify the primary current to suit the demands of the case. Thus, we have at the central station the primary generator, and then, wherever the current is utilized, a secondary generator placed on the premises, where it becomes the new source of energy.

The secondaries employed act on the same principle as the Ruhmkorff induction coil; but their construction is modified so as to obtain the effects desired, with as high an efficiency as possible. The Ruhmkorff coil, as is well known, consists of a core of soft iron, surrounded by a helix of coarse wire, termed the primary coil; around this, many layers of fine wire, called the secondary coil, are wound, so that when a current, passing through the primary, is suddenly interrupted, another is induced in the secondary, the character of which differs from that of the primary current. A similar action takes place in the secondary generators, but with the difference that the primary current is not broken, but alternates in direction; the iron core, then, instead of alternately losing and gaining its one polarity, has the polarity changed continuously. The result, however, is the same, and affords an easy means of avoiding the make and break.

In the ordinary induction coil the secondary coil forms one continuous circuit; but it is easy to conceive that if

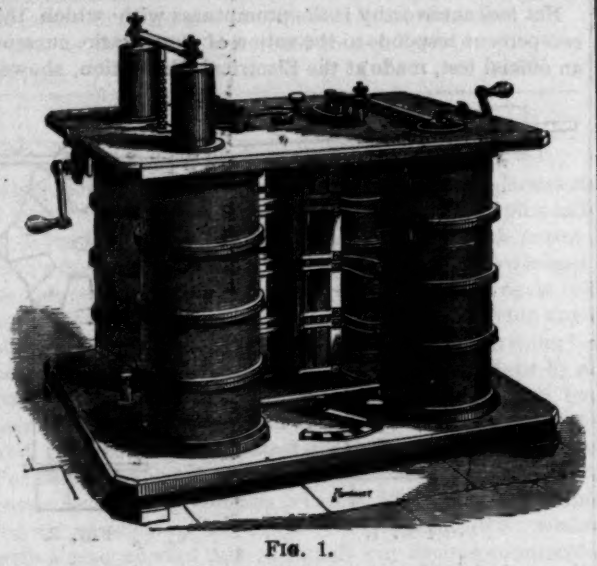


FIG. 1.

the secondary were constructed of a number of short lengths, the ends of the latter could be joined in a number of ways, such as in series, or parallel, or any other combination, and the effect produced with each change would be varied accordingly. In this way a current of high or low potential can be generated to suit any requirement. Such is the arrangement exhibited in Gaulard & Gibbs' secondary generators, one form of which is shown in Fig. 1, while Fig. 2 is a diagrammatic section of one of the coils.

Referring to Fig. 1, it will be seen that the apparatus consists of four vertical compound bobbins, and as these are identical in their construction, the description of one will serve for all. A core of soft iron *E* fits easily within a wooden or paper tube, upon which is wound an insulated copper conductor in three layers of spirals as in an ordinary solenoid. The diameter of this conductor is three millimetres. Over the cylinder thus formed, there are placed four bobbins *BB*, each wound with an insulated strand composed of six insulated copper wires each half a millimetre in diameter. These bobbins constitute the secondary circuit of the coil, and have each two spring terminals (Fig. 1) which rest upon a vertical commutator. This consists of a polygonal piece of non-conducting material, capable of being turned about its vertical axis by a handle shown at the top of the apparatus, and having conducting metal strips let into its surface. In one angular position the positive end of one bobbin is connected to the negative end of the next, and so on; in another position all the positive ends are connected together, and all the negative ends are likewise connected, while in a third position the bobbins are grouped in two series of two each. The upper and lower ends of the secondary conductor of each vertical set of four bobbins are connected to the terminals on the upper board, and by means of short pieces of wire these terminals can be coupled together so

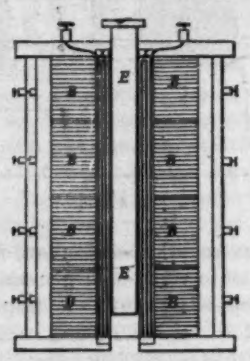


FIG. 2.

as to group the columns in series, or in parallel arc, or in two sets of two each. The drawing shows that the cores can be raised from the interior of the primary coils by racks and pinions, and in this way another means of varying the secondary current may be obtained, as the polar field may be partly transferred to a region where it has little or no inductive effect upon the coils. The main or actuating current enters the apparatus at the left-hand terminal on the bottom board, and leaves by a similar terminal on the right side, after traversing the primary circuits of the four columns. By means of the central handle the primary coils can be successively cut out of circuit, and the current sent along a by-pass conductor.

The diagram represented in Fig. 3 (for which, and the two preceding figures and detail, we are indebted to "Electric Illumination," Vol. II.), shows a central primary generator, with eleven secondary generators in circuit. The current passes from the dynamo through the successive primary coils and back again in one continuous circuit, the current in which is uninfluenced by the nature of the work performed by the secondary coils.

In order to obtain increased efficiency, Messrs. Gaulard & Gibbs have recently changed the form of their secondary generators, so that their new one, exhibited at the Turin Exhibition, appears as represented in Fig. 4. In this the induction coils consist of flat spirals, pressed one above another. The primary spiral consists of flat annular plates of sheet copper, ¼-millimetre in thickness and 3½-centimetres in width. At the point where they join each other, there is an eye in a kind of projecting tooth. This serves to connect the first annular ring to the second, which is again connected in the same manner to the third, and thus the primary coil is composed of a series of such plates.

Between each of the two annular plates, which are left bright, there intervenes a plate of the same metal and the same size, belonging to the secondary spiral, covered with a black insulating mass. Between the black and the bright copper plates there are further introduced rings of parchment as insulators. Thus a column, constituting a secondary generator, is formed of a great number of such flat rings. The first, third, fifth, etc., form the primary, while the second, fourth, sixth, form the secondary bobbin. There passes through the former the inducing current, of very high tension (2,500 to 3,000 volts have been mentioned).

Between the supports *SS*, fixed on a wooden base, the primary and secondary discs *P* are arranged as a column. The eyes which serve to connect each two consecutive rings are visible in the figure. *ZZ* are the clamps for intro-

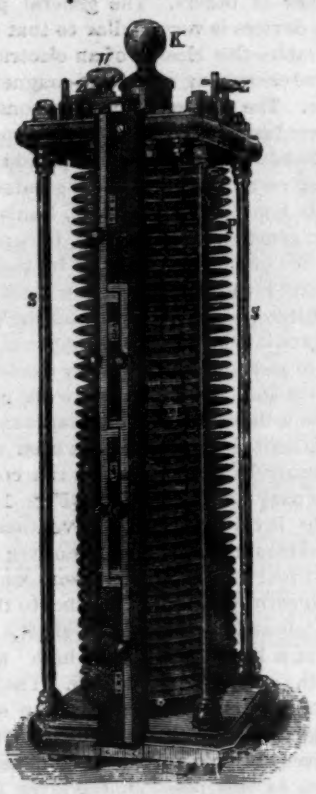


FIG. 4.

ducing the primary current; *H* is the handle for connecting or disconnecting the induction coil. The metal core *K* serves to increase or diminish the induction, according as it is pushed more or less into the induction coil. The inventors are attempting to produce this effect by an automatic arrangement, and thus obtain a self-regulation of the currents. The strips visible on the front bar *C* contain the connections for the secondary currents, which may be joined at pleasure for arc or for incandescent lights, or for both simultaneously.

As regards the performance of these generators, tests show that they rank comparatively high in efficiency. At the present time the Metropolitan Underground Railway of London is lighted for a distance of seven miles by this system, the primary current having an intensity of 10 ampères and an electromotive force of 2,000 volts. The total length of the primary circuit is 15 miles and consists of a copper strand of No. 8 B. W. G. carried on insulators fixed to the brickwork of the tunnel. There are four stations, with a secondary generator at each, and the total number of lamps burning is 100 Swan and 6 arc lamps.

In our issue of Nov. 29 of last year there will be found a detailed description of the work performed by Gaulard & Gibbs' generators at the Turin Exhibition. The experiment consisted in lighting various arc and incandescent lamps on a circuit 80 kilometres (49.7 miles) in length. The tests made on that occasion showed an efficiency of from 89 to 90 per cent., and the inventors were awarded a prize of 10,000 francs.

Although, as stated above, the system contemplates the distribution of power as well as light, the former has not as yet been performed, as no motor has been designed for utilizing the alternate currents generated by the secondary generators. The inventors, however, assert that they will soon be able to furnish one, or if need be, devise apparatus which will rectify the alternating current and make it

continuous, so that it can be used in motors as constructed at present, as well as for electro-chemical purposes.

While it may reasonably be claimed that the Gaulard & Gibbs system, as first brought out, is not new, still its later development must be admitted to possess a high degree of novelty and to reflect credit upon the ingenuity of the inventors, who have succeeded in bringing the induction coil to such a high state of efficiency as to permit of its being used for purposes from which it has heretofore been debarred. The system cannot as yet be considered complete, but, judging from its present condition, it promises well and is certainly worthy of careful consideration.

Spellier's Time Telegraph System.

Time may be said to be the principal factor by which we regulate our daily lives. The enormous impetus which science has received during the last fifty years, together with the universal spread of railroads and industries, has long ago created the necessity for a convenient method of ascertaining the exact time from a standard clock, without going to the expense of procuring one. What was wanted, therefore, was a system that would transmit the time of a standard clock to secondary ones at a distance. The successful working of the electric telegraph gave a simple means for the solution of the problem, and we thus found that Steinheil, one of the early investigators in the field of telegraphy, constructed instruments for the transmission and reception of time by electricity. Steinheil's contemporaries, Wheatstone and Bain, also occupied much of their time with the same object, and they were followed by Siemens, Garnier, Stoehrer and a number of others. The general principle underlying all the devices is very similar to that of the ordinary Morse telegraph—the closing of an electric circuit at one end of the line energizing an electro-magnet which attracts an armature. The various apparatus constructed for the purpose differed considerably, and while some actuated the secondary clocks every minute, others did so every second. They all had certain defects to a greater or less extent, and it was to remove these that Mr. Louis H. Spellier, of Philadelphia, constructed his time telegraph. That the invention is one of merit is attested by the fact that Mr. Spellier received the Elliot Cresson gold medal of the Franklin Institute, and those who had the good fortune to be present at the late Philadelphia Electrical Exhibition will no doubt have seen some of the many clocks of the Spellier system in operation. For those who were not so fortunate, we give below a description of the apparatus which, although an American invention, has been introduced to a far greater extent in Europe than in this country.

The accompanying illustrations, Figs. 1, 2 and 3, show the principle involved in this invention. *A* is an iron wheel divided into equal segments, each segment representing an armature; *B* is the escapement wheel, which has inclined teeth corresponding in number to the armatures of *A*; both wheels are attached to one shaft. *L* is a weighted lever carrying a little roller *P*, which presses against the teeth of the escapement wheel *B*. The electro-magnet *M* will attract an armature as soon as the electric current passes through the coil; this armature will take its position right over the pole of the magnet as represented in Fig. 1. When in this position, the lever *L* is raised and presses the roller *P* against the upper part of a tooth of the escapement wheel *B*. As soon as the circuit is broken, the weight of the lever will move both wheels in the direction indicated by the arrow, and put them into the position shown in Fig. 2. The armature 1 is now removed from the pole of the magnet, while the armature 2 has approached it closely. When the circuit is closed again, this armature will be attracted, and the roller *P* will raise the lever and pass over the apex of the next tooth of the escapement wheel, where it will remain, until the circuit is broken again, when the same action already described will be repeated. A spring may be substituted for the weight on the lever, which will allow the escapement to act in any position.

It will be seen that by this arrangement not the slightest blow is imparted either to the armature or escapement wheel, for there is no impact. Nor is the armature submitted to that objectionable instantaneous check when arriving at its halting place, for before coming to a complete standstill it will describe a few short but quick vibrations over the pole.

How remarkably silent in action clocks, provided with such an escapement, can be made to go, was shown at Philadelphia, where a seconds-beating clock with a large second-hand was exhibited; no sound was perceptible, even when the ear was pressed against the frame containing the clockwork. One of the most noticeable points of this escapement is, that it utilizes the very power which in other systems is not only wasted, but also constitutes an objectionable feature. This is the power inherent in the moving armature, the pressing-lever becoming the recipient of it. For, when the latter is raised, it prevents the armature from too rapid a flight toward the magnetic pole, and stores up sufficient power—when the roller has passed over the apex of a tooth—to move the armature twice this distance at the breaking of the circuit. A glance at the diagram will show that the two sides of the teeth of the escapement-wheel are of different inclination, and, therefore, of uneven length. The shortest side, which occupies but one-third of the space given to each tooth, is the one that raises the lever while the armature moves towards the pole; on the other hand, the longer side, which occupies the remaining two-thirds of the space, is moved by the lever; the distance of the latter movement is, therefore, just twice that caused by the magnetic force. That this movement is the result of power stored up in the lever is self-evident; a rather convincing experiment, also shown at the Electrical Exhibition, demonstrated this in the most practical way, as one Leclanché cell was sufficient to move three electric dials.

Not less noteworthy is the promptness with which this escapement responds to the action of the electric current; an official test, made at the Electrical Exhibition, showed

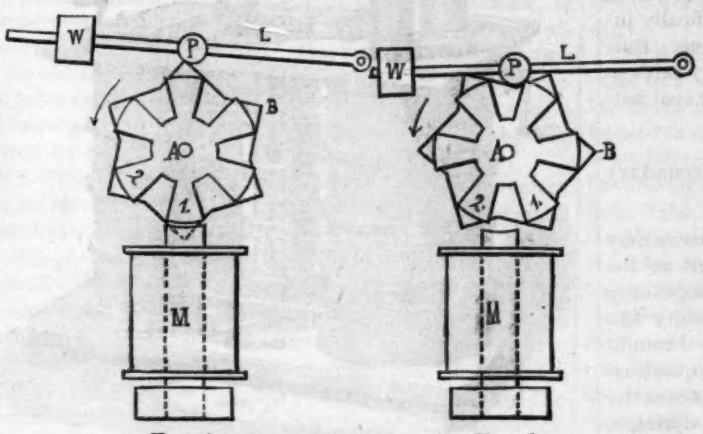


Fig. 1. Fig. 2.

that a closing of the battery for but one-tenth of a second was fully sufficient for a secure action. Fig. 3 shows the complete mechanism of Spellier's Time Telegraph in its latest form. Most of its parts will be understood without explanation. The magnetic poles are placed in a position directly opposite each other and the armature wheel between.

The advantage of this is easily understood. The armature wheel will be attracted in two opposite directions and relieve its bearings of all pressure or wear. This also permits the armature wheel to come into close proximity to the magnetic poles, without the danger of an actual contact.

The pressing lever bearing against the escapement wheel from below relieves its bearings of a great portion of its weight, and makes the wearing tendencies practically nil.

Simple as the device is, it appears to meet all the requirements of a good system; and while Europe is said to be still ahead of us in the matter of the adoption of time tele-

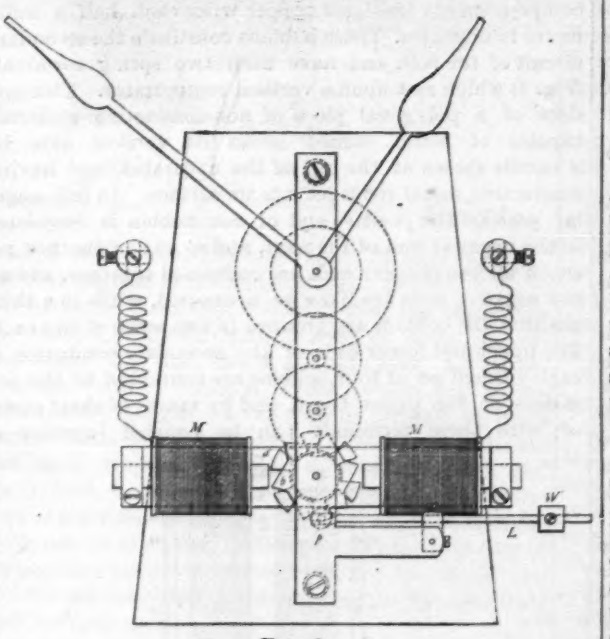


Fig. 3.

graphs, our late adoption of standard time for certain districts cannot fail to effect their general introduction here, and to raise time-telegraphy to an important industry.

The Evansville Hybrid.

The stockholders of the Gas and Electric Light Company met on the 19th inst. and elected the following directors for the ensuing year: Francis S. Reitz, Robert K. Dunkerson, Samuel Bayard, William Heilman, Thomas E. Garvin and Jacob Eichel.

The directors then met and elected the following officers: Francis J. Reitz, President; Robert K. Dunkerson, Vice-President; Samuel Bayard, Treasurer; J. B. Hall, Jr., Secretary; I. C. Baxter, Superintendent of Gas Department; G. M. Hoag, Superintendent of Electric Department.

Secretary Hall's report, showing the number of new consumers and the condition of the company's business generally, was read and approved. The directors were pleased with the showing, and will continue during the following year the enterprising and energetic policy of the last.—*Evansville (Ind.) Public.*

The Bell Patent in Canada.

The decision of the Minister of Agriculture against the Bell patent has awakened considerable interest in Canada, aside from the special merits of the case. The objections raised find expression in the Montreal *Shareholder* as follows:

The fortunes of legal warfare have for once turned against the Bell Telephone Company, the decision at Ottawa in its contest with the Toronto Telephone Manufacturing Company having been adverse. Hitherto the former has had nothing but uniform successes to record in its assertion of its rights in other countries, where the litigation in which it has been engaged has been almost incessant and always triumphant. Elsewhere the Bell Company has, in all these fights, been called upon to defend its claim only as to the originality, or priority, of the invention, which it has invariably succeeded in maintaining. At Ottawa, however, its latest adversary was careful not to embarrass its position by raising this special point in any way. The experience of similar previous attempts in England and the United States no doubt warned the disputant telephone company effectually against the danger of weakening its ground by issuing any such challenge. Thus it was only enabled to come into the quasi legal arena through certain provisions of the patent law of Canada, peculiar to the Dominion itself, and entirely unknown elsewhere. These declare that no patentee shall import the thing patented for more than one year after the date of the grant; and that after that date he shall manufacture within the Dominion itself such article to the extent required by the demand. The failure to comply with the law in regard to these two conditions formed the main ground for this late attempt to invalidate altogether the Bell patent. There were other minor issues involved, but it is on these two that the complainants mainly rested. The Minister of Agriculture has declared the *laches* proved against the Bell Telephone Company—a decision which, if finally maintained, absolutely renders null and void the Canadian patent, and thus throws this business legally open to the enterprise of any such as conclude they can see a profitable chance of embarking in it.

The printed evidence has not yet reached us, but it seems that on such simple questions of facts as those involved no trained professional knowledge is necessary to solve them. Any man of ordinary intelligence, with the testimony before him, should be able to decide this quite as well at least as the ablest of lawyers. Perhaps even better, for he would have no internal legal subtleties raised and to be disposed of. But none the less, all these proceedings bring us face to face with a condition of things certainly unique, and, we have no hesitation in saying, involving the greatest possibilities of danger, even to the extent of irremediable confiscation, to personal rights and property. In this contest, the defendants have literally millions of money invested in their enterprise. Yet one single irresponsible individual, the Minister of Agriculture for the time being, is endued with authority under this astounding statute to dispose irrevocably of property under his own personal and fallible judgment. And from that decision, wise or unwise, just or misdirected, honest or corrupt, *there is absolutely no appeal!* In this very case, the Bell party, with arguments at all events deserving of respectful consideration, dissent from the interpretation put by the Minister of Agriculture on the meaning of the term "manufacture" as used in the Patent act.

The wrongs that are possible under so monstrous a statute are too self-evident to require to be pointed out. Had this case, or any other such as this, been brought before any of the ordinary legal tribunals, errors or misdirection of the judge could have been challenged, and exhaustively reconsidered in higher courts. In this case a very intelligent farmer construes the law and calls in the aid of a medical man to advise with him. The latter, indeed, happens, by a chance not at all likely ever to be repeated, to be a gentleman of singular capacity for the kind of work involved in such inquiries. The admirable and exhaustive manner in which he dissected the evidence in another contest (Barter v. Smith) having some points of identity with the present one, and the thorough soundness of his final judicial decision, elicited the expressed eulogium of the Supreme Court itself. But men of the Dr. Taché calibre are rare, and not officially immortal. It has to be remembered, besides, that the decision of that gentleman entirely failed to satisfy the public mind as to its soundness until the highest court in the country had indorsed it. But the great point of all is that this one-man power, without appeal, is so monstrous, so capable of being perverted to the most corrupt and oppressive purposes, that if not absolutely unconstitutional it should at once be made so, being noxious in itself and righteously odious to the entire public sentiment of any British community. It is not bringing into question the probity of either of the distinguished gentlemen who have just pronounced on the Bell case at Ottawa to say that no such decisions will ever command the confidence and respect of the public. Great interests like those here involved, or even small ones, demand much

higher and more solid guarantees that justice and law will be properly administered. We trust, therefore, that the defeated defendants will leave no stone unturned to have the constitutionality of this most extraordinary statute decided by the courts whose judgments carry with them the respect of the community.

A New Police Patrol and Time Indicator.

Although police administration is already served in various ways by electricity, we still find additions being made constantly, for the purpose of improving and simplifying the applications already in use. One of the latest attempts in this direction is that presented by the Police Patrol and Time Indicator system of Messrs. Pearce & Jones, described and illustrated below.

As indicated by its title, this apparatus is intended to act primarily as a check upon and a record of the patrolmen, who are expected to signal their presence at each box station, and receive their orders and instructions from the central office, the apparatus serving as an auxiliary and assistant to the roundsman or other officer having charge of the officers on duty; in addition to which it is adapted to use as a means of communication between the patrolman on duty and his superior officer, thus permitting the transmission and execution of orders with secrecy, accuracy and dispatch, and can also be used to send in special calls, as for an ambulance, or a notification of the occurrence of fire, etc.

In addition to this primary use of the apparatus, it is intended to be accessible to responsible citizens for the purpose of calling for police assistance, an ambulance, or the presence of the fire department.

The method of transmitting fixed or automatic signals and messages by this apparatus consists of a series of simple movements of a lever attachment, which, in addition to transmitting the number of the box, indicates a call for police assistance by *one* movement, and that for an ambulance by *two*, and for fire by *three* movements, thus avoiding the use of indexed dials and other intricate contrivances. In addition to these fixed or automatic signals, an almost endless variety of complete messages can be transmitted by the use of a telegraph key within the case, using the ordinary police code of signals as a guide, a pocket edition of such code being furnished each officer (or printed on a card to be left in the box). It will thus be seen that the liability to error and confusion in the transmission of signals and messages is reduced to a minimum.

The application of the system consists in the location of a series of street box stations, each electrically connected with the other, and the whole centered at police or precinct headquarters, a central station, or such other point as may be selected.

The apparatus of each street box or station, Figs. 1 and 2, consists of an automatic signaling device, with its actuating lever, signal bell, telegraph key for code signals, special messages, etc., all carefully mounted inside of an iron case to protect them from the weather, the automatic part being inclosed in an extra inner iron case which is securely locked when the apparatus is not being used.

The apparatus at the central office or police headquarters consists of an automatic registering apparatus, relay, bell and signaling key, carefully mounted in a substantial and ornamental case. In addition, there is a detached clock, which by electrical contact continuously records in ink on a strip of paper the passage of time in such divisions of the hour as may be desired.

For the purpose of illustration, we will suppose that patrolman number 41 is at box station 32 on his beat, and desires to report to headquarters, time 2 o'clock P. M. Then the method of procedure will be as follows: The patrolman, after unlocking the box, will pull down the lever actuating the automatic signaling device, and then let it return to its original position. This manipulation of the lever transmits and records the box or station number at the central office. He then pulls the lever down once more and holds it down, while with his right hand he uses the telegraph key to send in the signal "2–2," which is a notification of his desire to communicate with the central office. The person in charge answers his signal by "2," and upon the receipt of this return signal, which is sounded upon the bell in the case, the patrolman transmits his number, "4–1," to which the central office signals the reply "2–3," which means "I understand you," upon the receipt of which signal the patrolman releases the lever, which, in its return to its normal position, again transmits the number of the box; he then closes and locks the box, and proceeds on his regular rounds.

The record on the tape would be as follows:

2 o'clock,

3-2	2-2	2	4-1	2-3	3-2

which being interpreted, relates, that between the hours of 2 and 2:15 o'clock box 32 was pulled, the central office call (2–2) was acknowledged by return signal (2), the patrolman's designating number (4–1) sent in and acknowledged by return signal (2–3), and lastly, the box number again recorded, neither the central office nor patrol man having anything else to say. Should the central office have anything to communicate to the patrolman, it can then be done by a code of signals. From the above explanation it will be seen that the system possesses a number of valuable features and gives convenient control of a large number of men. For thinly populated districts, where policemen have long patrol beats, a ready means is hereby afforded of summoning aid at short notice, should occasion require it; while with a preconcerted code of signals any desired communication can be transmitted either to or from central station. The system has already been adopted in several places, one among them being the Second Police Precinct of New York City, where its use is giving satisfaction.

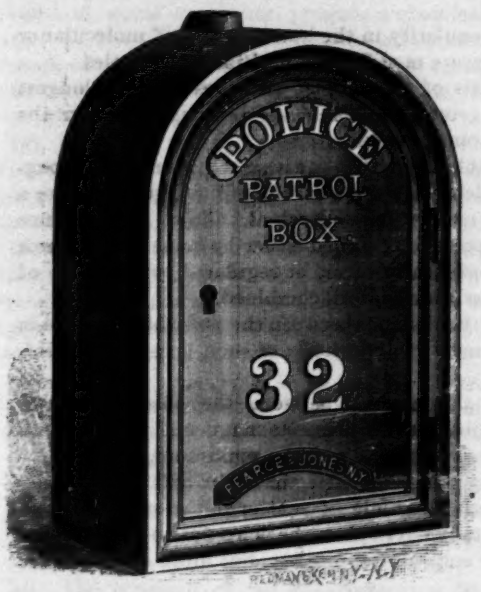


FIG. 1.

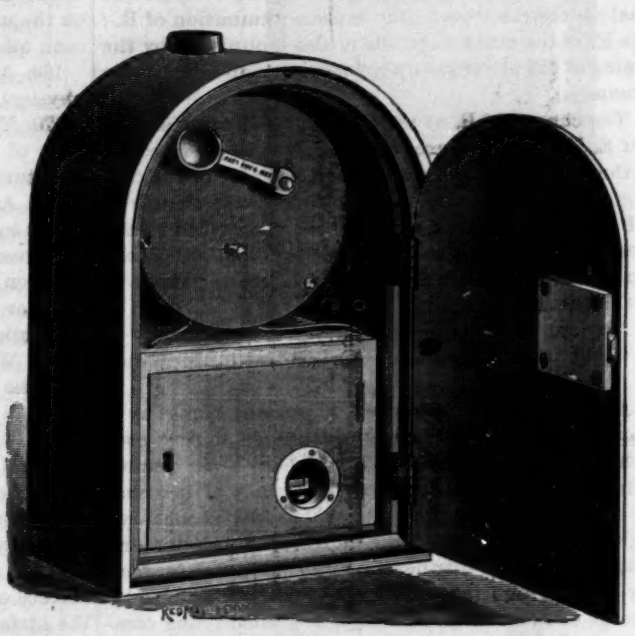


FIG. 2.

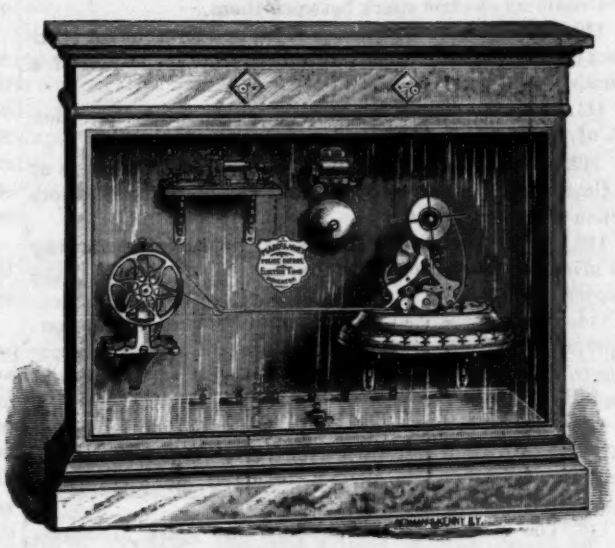


FIG. 3.

Cable Interests.

A dispatch of Feb. 5. from London, says: "The half-yearly meeting of the Direct Cable was held this afternoon at the Cannon Street Hotel, Mr. John Pender, M. P., in the chair. The attendance was small. The report submitted shows a difference of about $25,000 in last half-year's receipts, less than the corresponding half-year of the previous year; but the working expenses were $15,000 less, and a net profit of $250,000 was reported. After the report was adopted a dividend of five per cent. was declared. Mr. Pender then spoke. He stated, in reference to reductions that there was no doubt whatever that the real object of Messrs. Mackay & Bennett was to make money. He then, referring to press rates, added that the Commercial Cable Company was fully occupied, simply in transmitting press messages to Associated Press and all other correspondents, and also to the *Herald* and *Telegram*, at the rate of five pence per word, while the Direct Cable Company found plenty of commercial work at one shilling and eight pence per word. He said that he did not think that Messrs. Mackay & Bennett would be satisfied with a return of only two and one-half per cent on their capital, and would soon find a remedy which would bring higher interest. He assured the shareholders that the fact that the direct cable was broken would not affect receipts very much, as all work was sent to the Anglo-American, and in reality they (the Direct Cable Company) were backed by all the other old cable companies. He hoped that in a short time the broken cable would be repaired. The meeting was very quiet, but a stormy meeting is expected for the Anglo-American Company to-morrow. Field's friends will defend him, and declare him the American backbone of the cable company, and fitted by experience, repute and honor for any trust committed to him."

The announcement from London that Mr. William Abbott and other stockholders of the Anglo-American Cable Company had started a movement to oust Mr. Cyrus W. Field from the directorship, naturally caused much comment in cable circles in this city. A *Telegram* reporter saw Mr. Field, and asked him what he intended to do in the matter.

"Oh, I have telegraphed to my representatives in London, asking them to look out for my interests," was Mr. Field's brisk reply.

"But Mr. Abbott and his friends have intimated that you are unworthy of any position of trust," the reporter observed.

"I am ready to meet any charges that may be made against me. As I said before, I have telegraphed my instructions to London. I am now awaiting a reply. Until I get the reply you must not expect me to say anything further on the subject. Come and see me a little later and I may have some news for you to publish."

Electrical Transmission of Power at Providence, R. I.

An informal reception was given to Leo Daft at the Narragansett Hotel, Providence, R. I., on Jan. 27, by Mr. William A. Harris and other prominent citizens of Rhode Island who are interested in a company recently organized for the practical application of the Daft system for the electrical transmission of power. There were present Governor Bourn, Lieutenant Governor Rathburn, Speaker Jilson, of the Rhode Island House of Representatives; Secretary of State Addeman, Mayor Doyle, Rev. Dr. Robinson, of Brown University; Chief Steere, of the Fire Department; Z. L. White, of the Providence *News and Star;* L. W. Clarke, George C. Tingley, chief engineer of the Union Railway Company, and other prominent citizens of Providence, and Charles Whittier, D. W. Russell, H. McL. Harding and J. E. Sayles, of Boston. After an elegant and substantial lunch had been discussed, the company was called to order by Mr. Harris, who stated that the object of the gathering was to pay a tribute of respect to Mr. Daft in acknowledgment of the important part he had borne in the development of electricity.

What others had promised to do he had actually accomplished, and so the power generated by electric motors was to-day being actually rented to consumers distributed in different parts of the city, first in Boston and now in the city of Providence. He then presented Mr. Leo Daft, who was received with applause, and proceeded to give a review of the history of the development of electromotive force from the days of Jacobi down to the present time.

At the conclusion of Mr. Daft's remarks, Mr. J. E. Sayles, of Boston, the general agent and manager for New England of the New York Exhaust Ventilator Company, was introduced, and delivered an interesting address on the application of the Daft motor to fans for the purposes of ventilation, giving instances of his practical experience in its use. He pronounced it a perfect success, and dwelt upon its great value, particularly in the ventilation of public buildings.

Mr. Charles Whittier, of the Whittier Machine Company, was called upon and gave an account of his experience in the application of the motor for running elevators, which it is now doing with success and economy.

The company were then invited to take carriages and visit the Harris-Corliss engine works, where a central station has been established for the generation of electric current and its distribution by the Daft system, and they were then taken to offices a mile distant, where they were shown machinery in actual use, driven by current furnished through wires from this central station.

The People's Telephone Company.—A meeting of the stockholders has been called at No. 39 Broadway, New York, Feb. 11, "for the purpose of authorizing and directing the board of trustees to procure the requisite means by voluntary contributions, pro rata, of the stockholders, or by the sale of such of its assets as may be required, to pay the floating debt and the expenses to be incurred in the conduct of the company's business."

Analytical and Systematic Method of Inventing.

BY EDWARD P. THOMPSON, M. E.

(*Continued from page* 26.)

According to Rule 3 and its explanation, the inventor may proceed by either or both of the following steps:

1. Decide upon what device or process you wish to invent, according to Rules 1 and 2, and then seek a principle which you think may be applied.

2. Study each principle exhaustively, in order to discover any possible application of it to any purpose whatever.

The following are a continuation of principles already given. They have been deduced, by a critical consideration, from the facts of physical and chemical science:

97. Conductors of electricity are changed as to their molecular condition by C.

98. C. produces heat in a conductor.

99. In some cases and under certain circumstances heat in a conductor produces C.

100. C. is always accompanied by heat.

101. Heat is always accompanied by C. (?).

102. Current passed through a conducting compound liquid always produces chemical action.

103. Chemical action sometimes generates C.

104. Chemical action always produces C. (?).

105. Kaolin possesses the exceptional property of conducting C. when heated.

106. Selenium possesses the exceptional property of conducting C. when exposed to light.

107. Luminous paint (sulphide of barium, strontium or calcium) becomes luminous by the effects of C.

108. A fine wire or carbon filament becomes luminous when heated intensely by C.

109. Two electrodes when nearly in contact become luminous, provided the E. M. F. is sufficiently great to maintain an electric spark between them.

110. Two electrodes, when pointed and brought into contact at their points, become luminous by the effects of a passing C.

111. A nearly perfect vacuum becomes luminous when C. of very high E. M. F. traverses it.

112. A nearly perfect vacuum of different gases, one at a time or mixed, becomes luminous and of different colors when traversed by a C.

113. The colors and shades as produced according to principle 112 depend upon the nature of the gas, the degree of vacuum and the E. M. F.

114. Sparks produced in non-conducting or feebly-conducting liquids are of different colors and shades, according to the nature of the liquid, the density of the liquid and the E. M. F.

115. In oils, the spark is of a greenish white; in bisulphide of carbon and turpentine, of a scintillating and brilliant white, and in alcohol, of a red and crepitating appearance.

116. The C. employed to produce the spark in liquids or rarified gases, and intended to produce best effects, is more efficient if it is a C. from an induction coil or else a C. from a frictional machine.

117. The steadiness of an arc or spark depends upon the constancy of the E. M. F., of the distance between the electrodes, of the temperature of the electrodes, of the motion of the surrounding atmosphere, of the chemical nature of the surrounding atmosphere, upon the homogeneity of the molecular structure of the carbons, the steadiness of the electrodes in relation to each other, the degree of constancy of the shapes of the ends of the electrodes, and the combustibility of the material of the electrodes.

118. A counter E. M. F. is a result of a spark.

119. The counter E. M. F. depends upon the resistance of the heated material between the electrodes.

120. The R. varies with the distance between the electrodes, with the temperature of the electrodes, with the amount of carbon particles and other chemical elements and compounds between the electrodes and with the temperature of the said chemicals.

121. A production and a variation of the counter E. M. F. cause a variation of the primary E. M. F.

122. Variation of counter E. M. F. causes variation of C.

123. An increase of counter E. M. F. causes a decrease of C.

124. The shapes of the ends of the electrodes will remain pointed, provided the density of the carbon of the two electrodes varies in the right proportion in each from the centre outward.

125. A uniformity of change of density from the centre of the carbon outward, or a uniform alternate or intermittent change of density from the centre of the electrode or electrodes to the outer circumferences will not affect the steadiness of the spark, provided the homogeneity of the structure exists throughout the whole length of each imaginary concentric cylinder of both electrodes.

126. Pointed electrodes produce less sudden change in counter E. M. F.

127. Difference of density from the centres of electrodes to the surfaces will maintain electrodes pointed.

128. Different materials from the centre to the circumference of the electrodes amount to same thing as difference of density of the same substance.

129. The material of one electrode deposits itself upon the end of the opposite electrode, according to the direction of the C.

130. A reversal of the C. changes the direction of deposit.

131. The deposit generally forms a crater on the end of the electrode when the opposite electrode end is in the form of a cone.

132. The form of deposit depends upon the shape, to some extent, of the end of the opposite electrode.

133. The form of deposit depends upon the relative natures of the materials of the two electrodes.

134. The form of deposit depends upon the direction of movement of the electrodes the one to the other, and changes, especially if the motion is in a direction not coinciding with the direction of the axes of the electrodes.

135. Electrodes may be either cylindrical, circular or spherical, or any cross sectional shape; or one may be of one shape and the other of a different shape.

136. The arc may be formed between the ends or elements of the cylinder, or between the circumference or surfaces of the discs or circles.

137. Spherical electrodes, especially if covered with an electro-deposit, have the minimum R.

138. Deposition of the material of one electrode upon that of the other decreases the R. of the latter and increases that of the former.

139. The wasting away of the material of *both* electrodes is due to their uniting with the surrounding atmosphere.

140. The shortening of the electrodes in consequence of their wasting away is a cause of decrease of their resistance.

141. The building up of the cross-sectional area of the electrode receiving the deposit, and the shortening of the same electrode in consequence of the wasting away of the material of the electrode, alike cause a diminution of R.; and the R. of the other electrode is also diminished by the shortening of the electrode by consumption and deposition of its material.

142. The change of R. of the consuming electrodes; the counter E. M. F. at the arc; the variation of distance between the electrodes; the change in the nature of the conducting material between the electrodes; the change of E. M. F. caused by other devices in the same circuit; the changes of E. M. F. due to irregularity of action of the electric generator—one or all *tend* to produce variations of current in the main circuit.

143. Any one of the causes in 142, or any two or more of them, *result* in an increased, decreased, or uniform current.

144. An increment or decrement of current caused by a variation at the arcs of two or more electrodes may be converted into magnetism through the agency of an electro-magnet; into mechanical force by the agency of an armature or core respectively of an electro-magnet or solenoid; into light by the passage of the increment through a fine filamental conductor; into heat in same manner as for converting the current into light; into chemical affinity by the passage of the increment through a conducting compound liquid; or into two or more of the forms of energy, magnetism, mechanical force, light, heat and chemical affinity.

145. Any one of these forces may be converted into mechanical force.

146. The mechanical force may be employed to readjust the distance between the electrodes, to readjust the current, the electrodes being supposed to approach each other with a slow and uniform motion, or with a regularly intermittent motion; to readjust an adjustable R. in the circuit; to compensate the diminution of the R. of the electrodes due to their wasting away, or to readjust or regulate the E. M. F. of the source of the C.

147. As the distance between the electrodes increases, a certain distance is reached where the arc ceases; the maximum decrement of C. is thus produced and the E. M. F. necessary to maintain the arc with the electrodes at a fixed distance is nearly independent of the current.

148. When the distance diminishes, between the electrodes, to zero, then the maximum increment of C. occurs; and the increase of E. M. F. varies in nearly the same proportion as the increase of distance between the electrodes, being about 54 volts per inch increase.

149. When the intensity of heat or light, at a unit's distance from the arc, remains constant, there is a uniformity of the C.

150. When the light comes more from the incandescence of the electrodes than from the arc or spark, the light has its maximum steadiness.

151. The light comes more from incandescence, the greater the C.

152. The expenditure of energy is much more economical per arc the larger the capacity of the generator.

153. The pressure of the surrounding atmosphere decreases when the arc or spark takes place between two electrodes.

154. The electric spark wears out even platinum points between which contact is frequently made.

155. The spark is diminished by momentarily diminishing the current while the contact is being made.

156. The same result follows by the use of a condenser between the contact pieces.

157. Cold gas between electrodes has a higher resistance than heated gas.

158. The distance at which an arc may be established between two electrodes depends not only upon the E. M. F., but also upon the temperature of the atmosphere between the two electrodes.

159. Differently colored lights and shades of light are produced by previously soaking the electrodes in solutions of soluble salts, especially such as potassic nitrate, caustic potash, zinc chloride and a mixture of borax and sulphuric acid.

160. Sounds are produced by the passage of C. or by induced C. through such metals as iron, tin, zinc, bismuth and lead, provided the wires of such be kept in a state of tension, and the current be intermittently broken.

161. When the arc is formed between electrodes attached to the terminals of a galvanic battery, the positive electrode rises in temperature while the negative remains comparatively cool; while when the discharge comes from an induction coil the negative electrode becomes hot while the positive remains comparatively cool.

162. The development of heat either at the positive or negative electrode is entirely due to the R. which takes place in that part of the circuit.

163. The force of magnetism varies inversely as the square of the distance.

164. The force of magnetism is a maximum at its poles.

165. The force of magnetism is a minimum at the centre of the straight line joining the poles.

166. The location of the poles depends upon the shape of the magnet.

167. A magnet has only two poles; but these poles may be exhibited by their manifestations at more that two points.

168. Whatever the shape of the magnet, provided it is homogeneous in its structure, the two poles exhibiting the maximum intensity of magnetism are at those two points on the magnet which are at a maximum distance from each other.

169. An irregularity in the homogeneity of molecular or physical structure modifies the position of the poles.

170. The axis of the magnet coincides with the longest axis of the geometrical mass of the magnet when the structure is homogeneous.

171. A flexible magnet or equivalent, or an elastic magnet or equivalent, or a tortional magnet or equivalent, or a compressible magnet or equivalent, allows the distance between the poles to be varied either by some outside force alone or automatically varied or regulated by the force of magnetism itself, or by both combined.

172. When the distance between the poles of a magnet is zero the magnetic field of force of each pole is at a minimum.

173. When the distance between the poles of a given tortional, flexible, or compressible magnet is greatest, the magnetic force of each pole is at a maximum.

174. Every particle of matter in either half of a magnet repels every other particle of matter in the same half, so that the resultant forces place the poles not on the extreme surface of the ends of the magnet, but more or less below the surface.

175. All the particles of matter in each half of the magnet attract all the particles of matter in the other half; so that there is a plane perpendicular to the line joining the two poles, in which the two forces neutralize each other and produce a plane of no magnetic effect.

176. The lines of force from the centres of the poles tend to coincide with straight radial lines from the centres.

177. These two sets of radial lines of force attract each other and produce lines which are not straight, but curve toward the opposite poles.

178. The degree of curvature depends upon the distance of the poles from each other.

179. These lines of force extend from the magnetic centre of the poles to infinity, according to the same law as that of gravitation.

180. Magnetic lines of force are modified as to their curvatures, not only according to principle 177, but also according to the repulsions occurring among the lines of force of the same pole.

181. The lines of force of the same pole repel one another, while the lines of force of opposite poles attract one another.

182. The degree of curvature of the lines of magnetic force varies with the distance between the poles.

183. The attractions and repulsions of the lines of force of a magnet or of two or more magnets obey the laws of the composition and resolution of forces.

184. These lines of magnetic force become manifest only through certain magnetic materials, the most important of which are iron and steel.

185. A mass of steel moved in certain directions before a magnet becomes itself a magnet and remains so indefinitely.

186. A mass of iron or steel in the presence of the lines of force of a magnet becomes converted, the steel permanently and the iron temporarily, into a magnet.

187. A mass of steel may be converted into a permanent magnet and a mass of iron into a temporary magnet by placing or moving it in a coil of wire through which passes a C.

188. A permanent magnet very gradually becomes weaker, but may be strengthened by hanging it in a vertical position and each day adding extra weight, and afterwards removing each day one of the weights.

189. The strength of a permanent magnet depends upon the manner or direction in which it is moved in a magnetic field; upon the quality of the steel; upon the relative dimensions and shape of the mass of steel; upon the length of time elapsing between its test and when it was magnetized; upon whether it is constantly used; whether or not it is always, when not in use, provided with an armature; upon the strength of the magnet or C from which it was made; and upon the capacity or point of saturation of the particular mass of steel.

190. A strong permanent steel magnet remains of the same polarity under a C. of whatever sign and medium intensity, being diminished in intensity of magnetic field by a current of one direction and increased by a current of the opposite direction.

191. An armature suitably balanced is attracted only by a medium C. of one direction if the core of the coil-magnet is a permanent steel magnet.

192. The same heating, chemical, magnetic or luminous effect of C. is produced by the resultant of two or more unequal C.'s as by a single one equal to the resultant.

193. Two coils wound in opposite directions upon a core and connected up with two circuits of equivalent resistances produce no magnetic effect by the passage of a current in one direction through both branches; but a magnetic effect is produced, simultaneously or alone, by a second C. passing in the same or in opposite directions, in one branch only.

194. Two equal C's branching from one current and heating portions of the branches, become neutralized in their heating effects in one or both branches by the passage of a C. of half or equal strength respectively through one or both branches.

195. C. may be interrupted by passing a C. of equal strength and opposite polarity through the source of C.

196. Two branch C.'s passed through two cells in parallel and of equal resistance produce a chemical effect in each cell; but a C. of equal strength and opposite polarity to each of said C.'s passed at the same time through one or both branches prevents any chemical action from taking place respectively in one or both cells.

197. C. passed through a cell or battery or dynamo or other source of C. in the same direction as that of the C. generated in said source, increases the total C, and diminishes it when passed in the opposite direction.

198. A weak C. passing through a coil will attract an armature which by its movements completes a circuit of a strong C., and said strong C. may replace or be added to the weak C., which by itself would not be sufficient to do the required work.

199. As the strength of C. is the same at every point of a main circuit, the additional C. may be completed near to or far from the source of the primary or weak C.

200. The additional C. may be either a stronger or weaker C., and may be used for strengthening the weaker C. or for an entirely separate circuit, which may in the same manner complete the C. of a third circuit, and so on to the last.

201. The strength of an electro-magnet is varied by winding it with two or more coils, and passing equal or unequal C.'s through two or more of them in the same or opposite directions, either automatically or by hand at the same or different periods of time.

202. A magnet wound with two coils in the same direction, the one being the main and the other a shunt wire around some variable resistance, varies in its magnetic strength.

203. A magnet wound in the same direction with two coils, the one carrying the main C. and the other a shunt around a variable resistance, varies in its magnetic strength by larger increments and decrements than if there were no shunt at all.

204. A magnet wound with a shunt around a variable resistance, varies in its magnetic strength by increments and decrements proportional to but smaller than those which would occur with the shunt coil substituted by the main coil.

205. A magnet wound in opposite directions with two coils, the one a main and the other a shunt around a variable resistance, varies in its magnetic strength with smaller increments and larger decrements than when wound with the two coils both in the same direction, provided the shunt be switched in circuit at each variation of the variable R.; because the current in each coil varies in the same sense and in the same proportion, so that one neutralizes, to a proportional extent, the strength of the other.

206. In the above principle, the less the resistance of the shunt the larger will be the decrements of strength of the magnet, and the smaller will be the increments, so that for certain size of shunt the increments of magnetic strength will be very small at each diminution of the variable R. and very large at each increase of the variable R.

207. A magnet wound with the main wire and in the opposite direction with one or more shunts around one or more variable R.'s varies in its magnetic strength in all proportions, depending upon the R.'s of the shunts, the number of shunts switched in at the same time, and upon the variation of the R. of the variable R. or R.'s.

208. In an electro-magnet wound evenly over its whole length, the field of force is the maximum at the poles and diminishes to zero at a point midway between the poles.

209. In an electro-magnet wound so as to form a cone at each end, the field of force at each pole is much more concentrated and intense than when wound evenly throughout its entire length.

210. In an electro-magnet wound evenly throughout one-half its length the field of force is approximately the same as when coned at each end.

211. In an electro-magnet wound so as to form a cone at one end the field of force at the said end is nearly twice as great as when wound evenly over the whole length and considerably greater than when coned at both ends, the length of wire and the C. in principles 208, 209, 210 and 211 being the same.

212. With a given core, a given length of wire to be wound on it and a given C., the method of coiling to produce the maximum field depends on the distance from the end of the electro-magnet at which the field is to be produced.

213. The field is most intense near the end of a magnet when all the wire is coned on that end.

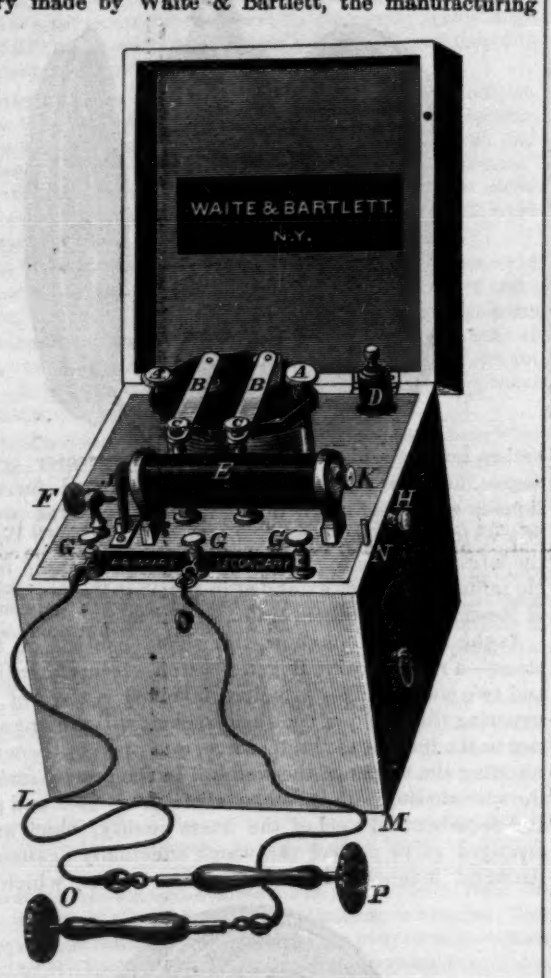
214. To establish the maximum field at a distance from the end of the electro-magnet to about a third of the length of the magnet, the core is to be wound uniformly over one half its length.

215. To produce the maximum field at a distance of over four-ninths of the length of the core, the latter is to be wound uniformly over its whole length.

(TO BE CONTINUED.)

The Waite & Bartlett Medical Battery.

Our illustration conveys an excellent idea of the family battery made by Waite & Bartlett, the manufacturing



electricians, of 204 East Twenty-third street, this city. It is solidly made, tastefully finished, compactly put together and convenient to handle. The parts and their relations to each other are of the usual character, and the operation is easily understood. In order to obtain a mild current the primary cell only is brought into play, and the cords are attached as shown in the engraving. The strength of the current can be regulated by drawing out the plunger tube *K*, at the right-hand end of the coil, by which means the current is increased as desired. If after drawing out the plunger tube to its full length the effect is still too weak, it can be increased by bringing the secondary coil into play. For this purpose the plunger *K* is pushed in again to its full length, the left-hand cord *L* removed from its binding-post and inserted into the one at the right hand. By again drawing out the plunger the current can be increased at will. A third and the strongest effect is obtained by attaching the cords to the two end binding-posts, which brings both coils into action. It will thus be seen that a wide range of effects can be obtained by this apparatus, which is applicable to a variety of electro-medical purposes.

Are Large Dynamos Economical?

Dynamo building is so young an art that any definite rules which may be laid down regarding it may require modification under certain conditions, and it appears that even at this early date an accepted rule may find its exception. Thus, the familiar assertion that economy of material is gained in the construction of large dynamos over small ones—or, in other words, that large dynamos weigh less per horse-power of energy developed than small ones—is shown not to be strictly true in the light of some recent experiments on the transmission of power. In proof of this, attention has been drawn to the experiments undertaken at Creil by Marcel Deprez. In this instance it is intended, as we have already mentioned, that the generating machines at Creil shall weigh from 35 to 40 tons for a current of 7,500 volts and 20 ampères, equal to 200 horse-power at starting. The receiving machines at Paris will weigh from 7 to 8 tons, and communicate to the shaft an available work of from 30 to 35 horse-power, whence it follows that the weight per horse-power will be about 175 kilograms (3½ cwt.) for the generator, and 200 kilograms (nearly 4 cwt.) for the receivers, under the most favorable conditions. Now, in the present machines, such as the Gramme, for instance, the weight per horse-power does not attain to 40 or 80 kilograms (rather over 7½ or 15 cwt.), according as they are used as generators or receivers. Therefore, the mean weight of matter per horse-power in large electrical machines will greatly exceed that of small machines.

This wide deviation from an accepted rule is of considerable interest as it stands, but it would be hasty to jump at conclusions. While the figures given may be correct, there may still be something in the nature of this particular case which might increase the weight of apparatus to the extent indicated. To generalize, therefore, from a single instance, would be an unwise proceeding, and until a full and complete record of the above experiments is available, any definite expression of opinion on the mooted question would appear to be somewhat "previous."

The Cost of Public Lights in Chicago.

City Electrician Barrett has completed his report to the Committee on Gas, in which he was to make an estimate as to the amount which should be charged for lighting the new city hall and tunnels with the Edison incandescent electric light.

Mr. Barrett strongly favors this system for these purposes.

Mr. Geo. S. Bowen, of the Van Depole Electric Manufacturing Co., has been making some figures in regard to the comparative cost of lighting Chicago by gas and by the electric light. He claims that the city could be lighted as cheaply with electricity as by gas, and that there would be saved to the city nearly $100,000, which is now expended for lighting and extinguishing the gas, for repairs, alcohol, etc. His figures are as follows:

Actual cost of gas for 1884	$227,737.22
Repairs of lamps, etc	17,759.71
Cost of lighting and extinguishing the gas lamps	58,709.91
Alcohol used for thawing out pipes	4,942.27
Total cost for 12,391 gas lamps	$309,149.11
2,377 kerosene lamps, material, lighting and extinguishing the lamps	$34,936.67
Repairing lamps	12,026.88
Making a total for 2,377 kerosene lamps of	$46,963.55
Added to the cost of gas makes a total expense of lighting the city of Chicago with gas and kerosene	$356,112.66

An average of 55 gas lamps were broken daily, making it necessary to use 192 boxes of glass during the single month of November last, and a total of 1,037 boxes of glass during the year, for repairing the lamps. All of these items, of course, are paid for by the city, the gas companies simply supplying *pure* gas.

If the electric light were used for the purpose of illuminating the city, the entire expense for lighting and extinguishing the lamps, as well as the repairs, alcohol for thawing out pipes, etc., would be saved, and might be utilized for the purpose of distributing more and better light.

These items alone amount to the sum of $93,438.77.

The Electric Gas-Lighting Controversy.

Since the statements of Mr. A. L. Bogart, referred to in our issue of Jan. 24, the following reply has been made by the Electric Gas-Lighting Company, of Boston:

"As Mr. Bogart omits to explain *how* his decrees were obtained, it should be stated that this company brought suits in equity for injunction and account against him, upon its letters patent covering electric hand-lighting devices, and took *prima facie* testimony long ago.

"Some time after this suit was instituted against Mr. Bogart, he brought cross suits against a former agent of this company. We offered to furnish counsel and assume the defense, but the offer was refused. We could not, under the law, force ourselves into or be heard in these suits against another party.

"As anticipated, however, these cross suits were not contested, nor was any evidence even taken! Mr. Bogart's decrees were obtained by consent of the defendants. They by no manner of means determine the questions of infringement at issue between him and this company.

"Decrees obtained by consent are not authority in any other suits, or between any other parties. Those referred to certainly have no significance whatever as to the real controversy over electric gas-lighting patents, and until Mr. A. L. Bogart obtains some decrees upon the merits of his patents in contested suits, his threatening letters to dealers in electric gas-lighting apparatus, made under this company's patents, will not be likely to have much weight among intelligent people."

The object of these statements is to show that the public cannot accept these decrees as in any way determining the controversy over the gas-lighting patents.

The Telephone in the West.

The Missouri & Kansas Telephone Company has had a remarkable growth during the last year, and it is probable that the present year will see the company entirely out of debt and able to resume dividends.

On the first of January, 1884, the company had 2,007 subscribers. On the 31st of December, 1884, they had 2,559 subscribers, making an increase of 552 subscribers, or about twenty-six per cent.

The net earnings for the year 1883 were $28,604.83; for the year 1884 they were $47,741.40, being an increase of $19,136.57, or about sixty-six per cent. The whole amount expended on construction was $48,183.47. Of this amount $3,992.10 was spent at Atchison; $32,321.81 at Kansas City; $2,169.94 at Leavenworth; $1,999 92 at St. Joseph; $832.98 at Topeka, and the balance has been used at other points in the territory. They have increased their mileage of toll lines, 75 miles.

The exchange at Mexico was closed on the 31st of December, being the only one closed during the year.

The greater part of their growth has been on the Kansas City Exchange, which has, as will be seen, received the greater part of the construction.

The United Telephone Company, under the same management as the Missouri & Kansas Company, makes the following statement:

In showing the increase of net earnings for the year 1884 over 1883, it should be borne in mind that as the company was organized March 1, 1883, it has been necessary to take the figures for the last six months of 1883, and double them, to make the estimate for the whole year.

On the 1st of January, 1884, the company had 1,192 subscribers; on the 31st of December, 1884, 1,319 subscribers, being an increase of 127 subscribers, or over ten per cent. The net earnings for the year 1883 were $7,288; the net earnings for the year 1884 were $9,231.81, being an increase of $1,943.81, or over twenty-six per cent.

The amount expended for construction was $10,631.79. Of this amount there was spent at the Burlington, Kansas, Exchange, $1,508.81; at the Winfield Exchange, $820.60; at the Lawrence Exchange, $2,341.86; and the balance has been spent in smaller amounts throughout the territory.

They have increased the mileage of their toll lines by 31 miles.

The Burlingame, Kansas, Exchange was closed on the 15th of May, and the Osage City, Kansas, Exchange on the 31st of December. The company is contemplating the construction of long lines to connect all of its more important exchanges.

A Telephone Ball in Kansas City.

The first annual ball given by the Kansas City employés of the Missouri & Kansas Telephone Company at the Board of Trade Hall, on Thursday night, Jan. 22, was a very enjoyable affair. The hall was handsomely decorated, and presented a very attractive appearance. Festoons composed of bunting and colored paper were extended across the hall from the chandeliers, which contained colored globes of different hues. A white banner, with "Hello!" worked upon it in large letters, was suspended across the west end of the hall, immediately in front of the main entrance.

Six telephones were placed in the hall; two were attached to the south side of the hall, two to the north and two to the west end; wires extended from each telephone to a large telephone pole erected on the platform at the east end of the hall, and from the pole were connected with a switch-board in the northeast corner of the hall, and from there were connected with the City Telephone Exchange, so that a person could speak to any person in the city having a telephone. Miss Ella McDonald operated the switch-board. Miss Susie Green, the electric girl of the evening, seemed to be the centre of attraction. She electrified those who would take hold of her hand. During the evening she lost a diamond ring, worn on the index finger of the right hand. It is supposed that while she was electrifying some gentleman the electric attraction was so great that it drew the ring off her finger on to the gentleman's finger; this, however, is merely a theory, and may be fallacious. An electrometer, Edison's phonograph, an incandescent lamp and various other electric instruments were placed on the table beside the "Electric Girl," and were viewed with a great deal of curiosity by hundreds of people who attended the ball.

The programmes containing the dances were very tasteful, and consisted of folding cards with a landscape and a telephone pole printed in gold on the front page, and a telephone in gold on the last page, together with the names of the following committees:

Reception Committee: D. B. MacQuarrie, David Livingston, Carson Edge, J. Cassidy, J. W. Harper, James Coleman, J. W. Davis, Edward Lind, Charles Boggs, P. Donovan, A. Barrett.

Floor Managers: Chief, Carson Edge; assistants, J. W. Davis, Ira Hawk, H. Smith, P. Donovan, Charles Boggs and H. F. Gynn.

Mr. P. McAnany, the prompter, called the dancers with three rings of an electric ball attached to the platform.

Supper was served at 12 o'clock at Green's restaurant, on West Fifth street. The ball was attended by about four hundred people.

New Zealand Notes.

The Auckland Exchange is to be shortly removed to a more commodious room in the building, where 1,500 subscribers can be provided for if required. On the year's business the telephone exchange receipts show a profit of over 30 per cent.

The Gulcher electric light has been successfully installed on one of our West Coast gold-fields. A telegram received here on Dec. 15 runs as follows: The Ross United Gold-Mining Company's works were lit up on Saturday night by the Gulcher electric light. The light, given from two arc lamps of 3,000 candle-power and a score of incandescent lamps, was steady and brilliant, and the dynamo was driven at the rate of 730 revolutions per minute by a turbine worked up to 7 horse-power. Photographs were taken by the aid of the light. The directors of the company were highly satisfied with the result.

A Magnetic Shield for Watches.

The oft-recorded fact that fine watches fail to keep good time when they become magnetized has led to the study of means to prevent such annoyance and expense. Mag-

netism may be said to be omnipresent to a greater or less degree, and it is well, therefore, to be prepared for occasions in which the magnetic field, unknown to the wearer of a watch, is strong enough to affect the latter. One of the latest attempts to protect timepieces from these invisible influences is that exhibited in the Anti-Magnetic Shield of Messrs. Giles Brothers & Co., of Chicago.

As the illustrations show, this shield consists of three pieces—a ring, surrounding the watch circumferentially, and two covers. The principle involved is that of constructing the shield of such materials as will present a barrier to the lines of magnetic force, and prevent them from reaching the works of the watch. In the present instance the surrounding case is composed of pure copper and gold, and decarbonized steel of the finest quality, which are so arranged as to protect the watch effectually against the strongest magnetic influence. The covers, which are

screwed on the rim, in addition to the above keep out all dust, thus serving a double purpose. The arrangement appears to be an effective one, judging from the number of testimonials of those who have applied it, and would be of special service to those engaged about electric machines, and particularly dynamos.

The Bidwell Electric Railway.

To the Editor of The Electrical World:

SIR: In reading Mr. Edward P. Thompson's interesting lecture, delivered at Cooper Institute, I note that he says: "The same current could be employed easily for lighting the train with incandescent electric lamps," and "At a future day the cars will be heated by the same force which propels and lights it."

I wish to call his attention to the fact that we have had cars running in Boston for three months that were propelled, lighted and heated by the same line current, and if he will call at our shop he can have the pleasure of riding in a car that is propelled, lighted and heated, and see eight arc lights over the railway, the whole plant being run with the same line current. BENSON BIDWELL.

PHILADELPHIA, Feb. 2.

WESTERN NOTES.

THE ELECTRICAL WORLD BRANCH OFFICE,
CHICAGO, Feb. 5, 1885.

In the Western Union building at Evansville an electric light wire came in contact with a telegraph wire, heating the latter to a white heat. The destruction of a few instruments was the only damage done.

Grand Rapids, Mich., thinks of adopting the patrol box system.

Janesville, Wis., is to be lighted by electricity.

It is reported that the Thomson-Houston people are negotiating for the rights and plant of the United States Company in Dubuque, Ia., which have been on the market for some time.

By the completion of a link around the north shore of Lake Superior, Manitoba has secured telegraphic communication with the Canadian capital outside of the territory of the United States.

Quite a commotion was aroused in the La Salle street office of the Chicago Telephone Company by the arrest, on the 29th, of one of the young lady operators, charged with alienating the affections of some one's husband. The friends of the young lady believe that she will be able to prove herself innocent of the charge.

Chicago's fire-alarm system will probably have connection with the conduits.

And now comes a man who proposes to cleanse the Chicago River by means of siphons, and from the power of the outlet of the siphons produce sufficient electricity to light the entire city and run an elevated railroad besides.

Further reports of the effects of the sleet storm continue to come in. At Dayton, Ohio, 150 electric light lamps were frozen up so that they could not be lowered for three days. In order to put in new carbons and keep the lamps burning, it was necessary to employ ladders to get up to them.

An entirely new motor is about to be sprung upon the public. Further than this, in regard to it, the writer is not permitted to say at present.

Mendota, Ill., is testing the Thomson-Houston incandescent electric lighting system with a view to adopting it. It is extremely well pleased with the results of the tests thus far made.

Alfred Booth is suing the Western Union Telegraph Company for five thousand dollars damages on account of a delayed telegram. On Dec. 14, 1879, it is alleged, he went to the office of the Western Union Company, and gave them a message which it took them five days to deliver in Philadelphia, the delay causing him considerable loss and injury.

Opperman Bros., of London, are establishing a branch factory here for the manufacture of incandescent lamps.

The Railway Telegraph Supply Company are doing a large repair job for the Western Union Telegraph Company.

The Western Electric Company have just added another 24-light dynamo machine to their plant in Rand & McNally's publishing house.

Three Ball engines of 60 h.-p. each are to be used to run the 180 Fuller lights, soon to be placed in the new North Side roller skating rink.

The Leonard Glass Works, of Detroit, have filed a bill in the Circuit Court, asking for the appointment of a receiver for the Chicago Insulating Company. The bill was temporarily suppressed. The company was organized Dec. 8, 1882, with a capital stock of $200,000, divided into 8,000 shares of $25 each. Its principal office is located in this city. Nathan T. Fitch subscribed for 4,000 shares—one-half the nominal capital—Thomas Sanford for 2,000 shares, and Charles H. Cleaver for the balance. George H. Leonard, Charles S. Cleaver, Robert S. Critchell, Thomas Sanford and William Richardson constituted its first board of directors. Nathan T. Fitch, in December, 1882, made a proposition to sell and assign to the company for $190,000 a contract made May 15, 1882, with the Martin Electric Wire Conducting Company and 5,100 shares of its capital stock, being a controlling interest in the company. The proposition was accepted and $190,000 worth of shares transferred to Fitch. It was further decided to raise $25,000 on bonds of the company. The president was authorized to execute a trust deed to W. C. Grant to secure payment of the principal of the bonds. This deed included all the property and franchises owned by the company. The Leonard Glass Works purchased sixty-six of the loan bonds, valued at $6,600. Default has been made in the payment of the bonds. The machinery and tools given as collateral security for the loan of $25,000 are said to be only worth $1,000. Fitch is still president of the company, and it is set forth that he may possibly remove the whole stock to New Orleans. Judge Tuley granted an injunction in the premises.

There is still another suit, in which electrical people are interested, in progress here. J. M. Hirsch, chemist and electrician, residing at 524 Carroll avenue, has begun suit against James W. Chisholm for $20,000 for breach of contract. Mr. Hirsch was desirous of working several inventions which he had made, and entered into an arrangement with Mr. Chisholm, by which the latter was to furnish the money. They began building a dynamo machine, capable of furnishing from two hundred to five hundred electric lights. As Mr. Chisholm has failed to furnish the

money which he had agreed to put in the business, $50,000, Mr. Hirsch brings the suit.

The Thomson-Houston Electric Company, from its Chicago office, 109 Wabash avenue, has lately put in operation the following electric light plants: Pontiac, Ill., 25 lights; Freeport, Ill., 30 lights; Fairbury, Ill., 6 lights; A. G. Spaulding & Bro., Chicago, 4 lights. They have also just closed a contract for a 25-light plant to go to Streator, Ill., and the last of the week will probably see it in operation. Blomgren Bros., photo-electrotypers, this city, who have lately had the Thomson-Houston light put in their place, say that they can now do work in six minutes which it formerly took them four hours to accomplish.

The United States Electric Lighting Company's apparatus has lately been put in operation in, or is now being set up at, the following places: New Montezuma Hotel, Las Vegas, N. M., three 300-light incandescent machines; new Royal Insurance building, Chicago, 1,200 incandescent lights; Rock Island, Ill., 40-light arc plant; Windsor, Canada, 40-light arc plant; Ypsilanti, Mich., 300 incandescent plant; Jackson, Mich., 250-light arc plant; Samuel Cupples' Wooden Ware Company, St. Louis, 150 incandescent lights; L. M. Rumsey Manufacturing Company, St. Louis, 100 lights; Crawford's dry goods store, St. Louis, 60 arc light plant.

THE TELEGRAPH.

Kansas City, Mo.—This city is becoming an active telegraph centre, and the business there gives employment to about 135 operators and train-dispatchers.

Failure to Deliver.—In the case of the Western Union Telegraph Company vs. Fatman the Supreme Court of Georgia has decided that where by reason of failure on the part of a telegraph company to deliver a message directed to a ship-broker whereby he lost a contract, the amount of his possible commissions was not too remote or speculative a measures of damages.

Reduction in Tolls.—The Baltimore & Ohio Telegraph Company has notified its customers and the public that it will make no charge for date on messages to and from Central and South America via Galveston, Tex. The Commercial Cable Company will make the same concession over their lines between New York and London. Rates to Mexico are $3 for 10 words, the former rate being $4.

Southern Complications.—A dispatch from Atlanta, Ga., of Jan. 29, says: In the matter of the Southern Telegraph Company application was made yesterday on behalf of the Bankers and Merchants' Telegraph Company, in the State Court at Augusta, for the appointment of a receiver, which was granted. As an application has been made in the Supreme Court here by Judge Lochrane for the appointment of a receiver, this case will be transferred to the United States Court and both applications be heard on March 2, the date set down for a hearing.

Postal Telegraphs.—At the meeting of the National Board of Trade in Washington, on Jan. 30, the question of adopting a resolution of the New York Board favoring a government postal telegraph and telephone provoked a great deal of opposition. Mr. Cook, of Cincinnati, who opposed the adoption of the resolution, asked whether if the telegraph lines had been under government control in November last, and all of the officers been of one political party, in view of the close vote in New York State, the people could ever have been brought to believe that a great fraud had not been committed. A call for the yeas and nays having been refused, Mr. Sperry asked that it be understood that the question of having the government buy up existing telegraph lines does not enter into the question under consideration. With this understanding a vote was taken and the resolution was adopted—21 to 9.

Lines in China.—The most recent link in the long chain of telegraph lines which is spreading with such rapidity over China is the land line from Shanghai to Canton. A line from Pekin to Tien-Tsin was opened a few months ago, and the capital of China was connected directly with London. Now the capital of Southern China is joined with the metropolis in the north, and as Canton was put in communication by telegraph with the frontier of Tonquin at the outbreak of the present political troubles in the latter district, the telegraph now stretches in an unbroken line from Pekin in the north to the most southern boundary of the Chinese Empire, and a message either from London or Pekin might reach the headquarters of the Chinese forces on the Tonquin frontier in a few hours. Four years ago the only telegraph line in China was one about six miles in length, stretching from Shanghai to the sea, and erected to inform the mercantile community of the arrival of vessels off the mouth of the river. The next important line constructed by the Chinese government will probably be one uniting Pekin with the great northern lines across Siberia at Kiachta. This will have to cross the whole of Mongolia, and will give the capital of China a third alternative telegraph route to Europe, a matter to which some political importance is believed to be attached in China.

Alleged Western Union Lobbying.—A dispatch of Jan. 30, from Columbus, O., says: In the House to-day the joint resolution of Mr. Roche, requesting the Ohio delegation in Congress to favor and urge the passage of Mr. Sumner's Postal Telegraph bill, was reconsidered and passed by a vote of 53 to 7. Mr. Bruce, of Hamilton, arose to a question of privilege in the House this afternoon, and stated that the votes of Messrs. Lowenstein and Peet, on the joint resolution of Mr. Roche, requesting Congressmen to vote for the Sumner Postal Telegraph bill, were recorded in the affirmative, and they denied that they had voted in favor of the measure. Messrs. Bohl and Brunner favored a committee of investigation and referred to a similar trouble at the last session. Mr. Roche claimed that this was another dodge of the Western Union monopoly to defeat his resolution, and charged that the lobbyists of that company had been working on the floor of the House to defeat the resolution. He charged that Mr. Bruce was in the pay of the Western Union, and held up a frank from that company, which he said had been furnished to members of the House, in order to control votes. Some of the Western Union officials were on the floor at the time Mr. Roche was speaking, but left immediately. It was stated that the Western Union officials had approached members on the Republican side and had used the argument that the measure was of a political nature and that it should be defeated. This charge was at once denied and denounced by the Republicans, and one of the most spirited of contests followed. The Democrats then endeavored to hedge and kill the resolution to investigate, but were so sharply held in line that the motion to investigate was forced through, although the author of the resolution voted to indefinitely postpone its consideration. In the Senate the resolution of Mr. Roche was read and referred to the Committee of Railroads and Telegraphs.

THE TELEPHONE.

Why Silence is Golden.—"Talk is cheap" loses its signifi. cance when applied to conversation through telephones rented at $36 a year.—*Concord Monitor*.

Chas. S. Smith, formerly with the Central Union Telephone Company, at Indianapolis, has been elected secretary of the Rocky Mountain Bell Telephone Company.

Jamestown, N. Y.—Under the management of Mr. W. F. Melhuish, the exchange has made a net gain of 93 subscribers in eight months. Ten toll-stations have been opened.

Mexicans Cannot Do Without It.—The *Mexican Financier* says the telephone has become in Mexico, as in all other advanced nations, an integral part of business life.

Brazilian Consolidation.—There is a project on foot to consolidate all the telephone companies in Brazil. The Tropical American Company has a large interest in the Brazilian companies.

Output of Instruments.—The output of telephones by the American Bell Telephone Company for the month ending Jan. 20, 1885, was 2,186, but as the telephones returned amounted to 2,484, there was a net loss of 298 telephones for the month, against a net gain of 379 telephones in the previous month. The net output in the corresponding month last year was 2,112.

Skating Rinks Forbidden.—It is said that great indignation has been aroused among the operators of the Metropolitan Company because the management has expressed its wish that they should not visit skating rinks, "as it interferes with business." The young ladies deny the accusation that they indulge to excess in roller-skating, and they say they will go to the rinks still, when they want to do so.

Erie December Statement.—The December statement of the Erie Telephone Company will show a net income of about $15,000. The loan of the Boston and Northern and Suburban companies to the Erie, about $40,000, will probably be paid in April, when shareholders will receive a dividend of $3 to $5 per share. It has practically been decided to abstain for the present from advancing subscribers' rates.

Wire-Cutting on Staten Island.—All the telephone wires on Staten Island were cut some time during Saturday night, the 31st ult., by unknown persons. A few days before, W. W. Shannon, who had been superintendent of the company for Richmond County, resigned. All the other employés had their salaries largely reduced by Mr. Shannon's successor, and some of them resigned. The new superintendent, Mr. Chute, said that he could form no idea as to who had cut the wires. He hoped to have them all repaired in a few days. The cutting was done at a number of different places, evidently to cause as much trouble as possible in making repairs.

Rates in France.—A decree of the President of the French Republic, signed on 31st December, 1884, by M. Jules Grévy, and countersigned by M. Cochery, Post and Telegraph Minister, fixes the rates to be levied for telephonic communication between the public at a "call" office and a subscriber or a non-subscriber at another "call" office. The rate for five minutes' conversation in Paris is 50 centimes (10 cents), and in the other towns of France, Algiers, or Tunis, half that amount. The rate for five minutes' conversation between two separate towns is fixed at 1 franc (20 cents), for any distance less than 100 kilometres, or 62 miles. This charge may be reduced to one-half when the two towns have been classed by the Post and Telegraph Minister as forming part of one and the same telephone group.

The Molecular.—Experiments have lately been carried on with the Molecular telephone between New York and Cleveland, the distance by wire being put at 700 miles. The Cleveland *Leader*, of Jan. 26, says: "All manner of talk was indulged in by both sides, and the time of day passed. It was 4:50 o'clock in New York and 4:19½ o'clock in Cleveland. The dynamite sensation was discussed, the weather in New York reported, and stories told, hard words like "Mississippi" put through the 'phone, as well as figures, and the spelling out of the names of the people at either end of the line. But what astonished everybody more than anything else was a song sung so clearly in New York that it was heard by two of the people here, whose applause was in turn heard in New York, and whistling was distinctly heard. Mr. Cooke, of the Postal-Telegraph Company, stood fifteen feet from the instrument here, and repeated sentences which were in return repeated verbatim back from New York, showing that the words had been distinctly heard at No. 49 Broadway. In fact every possible test was put upon the instrument. Two ear-pieces were used here, so that two people could hear at once, while three were used in New York City, so that five people could thus hear all that was going on."

THE ELECTRIC LIGHT.

Timkins' Veto.—Mayor Timkins, of Hoboken, N. J., has seen fit to veto the proposition for lighting the city by electricity.

Newport, R. I.—The city committee on gas and lamps has decided to advertise for proposals to light the parks and principal streets by electricity for three years.

In a Paper-Mill.—The paper-mill of Geo. H. Friend & Sons, at West Carrolton, O., is being fitted with the United States Company's incandescent lamps, the contractor for the work being Mr. A. E. Leitch, of Dayton, O.

Youngstown, O.—An electric light company composed of business men of the city has submitted to the City Council a proposition to light the city with 100 arc lamps for $8,000 per year. The offer will probably be accepted.

Carbons.—The Boulton Company has a capacity for turning out 2,000,000 carbons per month. The estimated consumption in New England is 5,000,000 a year. A calculation of total consumption can be made on the basis of the constant use throughout the country of 100,000 arc lamps.

Brockton, Mass.—The new church at Brockton is lighted by the Edison electric light. It has also an electric call in the minister's room and one in the pulpit, by which the sexton can be summoned, when needed. We hope, also, that the whole congregation may be brought into the circuit, and be gently and profitably electrified by the ministration in the pulpit.—*Christian Register.*

Montreal.—The electric light has played a very prominent part in the Winter Carnival at Montreal, and as applied to the Ice Palace called forth the warmest praise and admiration. The Royal Electric Company threw its station open to public inspection, and a great many persons watched for themselves the process of generating the current. An opportunity was also given to inspect the system of incandescent lighting from an arc circuit.

The Light in Canada.—The Canadian representatives of the United States Electric Lighting Company, Messrs. Ahearn & Soper, Ottawa, Ont., have placed eight plants in about as many months—a good showing. They are now installing a 400-light incandescent plant in the College of Ottawa, at Ottawa. The town of Pembroke, Ont., is lighted with their system, and has the honor of being the first town in Canada to adopt the electric light exclusively.

For the Marquis of Bute.—Mount Stuart House, the new family mansion which has been built by the Marquis of Bute on the Isle of Bute, is to be lighted throughout by electricity, and cables for about 400 incandescent lamps are already fixed, Mr. Massey, of Thyford, having charge of all the arrangements. The cost of the building is put at £700,000 by one authority, and £750,000 by another; but it will probably reach nearly a million before the work is completed. Lord and Lady Bute, the family and servants have been living in parts of the house for some time, and they use a large number of lights daily; so do the builders, who are working early and late to get the place finished.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Cable, b 52⅝, a 54; B. & M., b 3, a 7; Mutual Union, b 12⅛, a 14⅛; Postal stock, b 2, a 3; Postal sixes, b 20, a 23; Western Union, b 61, a 61⅛.

Mr. Gould told a Philadelphia *Press* reporter that he did not think there was anything in the report that Western Union was interesting itself in the Bankers and Merchants' Telegraph Company.

Telephone.—Am. Bell, b 217, a 218; Erie, b 19½, a 19¾; New England, b 30, a 30½.

The statement of the Erie Telephone Company for the quarter ended Dec. 31, 1884, shows:

Gross earnings	$141,916.44	Construction expenses	$16,597.28
Expenses	86,931.18	Surplus for quarter	38,387.98
Net earnings	54,985.26		

The company completed all extra-territorial work in hand during the quarter, expended $10,806.36 in repairs (which was charged to expenses), and $16,597.28 for new construction, in all $27,403.64, which the company submits is sufficient to refute the claim that the property was being allowed to deteriorate.

With regard to prices of Bell stock, the Boston *Herald* says: There is no new explanation to give of either the decline or rise. Room trading has much to do with the price, and room trading is speculative trading, which cares little for facts favorable or reverse, if so be that profits are garnered. As news items it may be said that the annual (10 months on account of the change in the fiscal year) report is nearly prepared, but will not, it is said, be printed until after the annual meeting. The company has lately had returned 1,000 instruments, for a majority of which one of its licensees never had any use, although royalties had to be paid the same as if they were in use. This is one of the reasons for the net loss in the output of telephones by the parent company. The company is said to have expended $100,000 on its experimental copper-wire circuit between Boston and New York. It is to be turned over to the Southern New England Telephone Company, which company, by the bye, is likely to soon pass under the control of the Bell Company upon the renewal of its contract.

Electric Light.—Am. Elec. com., b 2⅛; Am. Elec. pref., b 9.

MISCELLANEOUS NOTES.

To Telegraph to Moving Cars.—The Phelps Induction Telegraph Company was incorporated on Feb. 2 by a certificate filed in the County Clerk's office. Its corporators are Timothy Cornwall, Willard N. Candee, and Robert J. Cummings. The objects for which it is formed are "the manufacture of instruments and apparatus to be used for telegraphing to and between railroad cars while in motion and to and between railroad stations and to and between railroad stations and railroad cars, etc." Its capital stock is to be $2,500,000, divided into 25,000 shares of $100 each.

Underground Wires.—A special dispatch of Jan. 28 from Washington says: "Several Pittsburghers are feeling very good this evening on account of the favorable report prepared by the Committee on Public Buildings and Grounds in regard to the working of the wires of the Waring underground cable. The committee have examined into the operations of several miles of Mr. Waring's cable, which have been in use for some months between the White House, Capitol and departments, and are so well pleased with it that an appropriation is recommended for the extension of the system, and by which the government will become the owner of it. It is possible that the elements have contributed somewhat to their assistance; as the overhead wires have been working very badly during recent storms. The cable will be used for both telegraph and telephone purposes.

Locating Obstructions in Pneumatic Tubes.—No method has yet been discovered, it would appear, for removing

obstructions from pneumatic tubes, preferable to that resorted to in Paris—the location being determined by simply firing a pistol in the tube. The resulting wave of compressed air, traversing the tube at the rate of 1,000 feet a second, strikes the impediment, and is then deflected back to its origin, where it strikes against a delicate diaphragm, its arrival being recorded electrically upon a very sensitive chronograph on which, also, the instant of firing the pistol has been recorded previously. The wave of sound, on reaching the diaphragm, is recorded, and thence reflected back—a second time striking the obstacle, and returning to the diaphragm. This operation being several times repeated, several successive measurements are thus made of the time required by the sound-wave to traverse to and fro within the pneumatic tube.

The U. S. Senate Electric Bells.—The Washington *Star* says: The introduction of an elaborate system of electric bells in the Senate wing of the Capitol, enables the venerable doorkeeper, Mr. Bassett, by moving a handle near his chair in the Senate chamber to ring a bell in every committee room, not only in the wing, but in the basement rooms under the rotunda, and the central part of the building. In this circuit there are forty-nine bells, and miles and miles of wires which weave in and out through the interior intricacies of that mighty building. Competent authority says that Mr. John R. Galloway, of this city, has performed this difficult work with so much skill that not a single wire is visible on the walls and corridors. Objection was made to the introduction of the system at first, because of the apprehended damage to the walls and ceilings, and surprise is expressed at the ingenuity and skill with which this objection was avoided.

An Electrical Mail-Box.—A new electrical mail-box has been invented, says the Norristown *Herald*, by Messrs. E. E. Weaver and C. J. Fitzgerald. By simply dropping a letter in an ordinary letter-box on the ground floor the electrical alarm will ring in any of the upper floors, where the offices may be located, and will continue to ring until the mail is removed. By an ingenious device you can check the alarm, in case it may not be convenient to go immediately after the mail. It has been examined by telegraph and electrical experts, also the Philadelphia postmaster, who has highly indorsed its use in buildings where business is conducted on the upper floors. It cannot fail to be highly appreciated after once using. Its use for many private residences will also be appreciated, as in many instances the mail-carrier is allowed to remain a considerable time on doorsteps, the occupant assuming that it is some huckster, but this annoyance to both the mail-carrier and the occupants can all be obviated by the adoption of the electrical mail-box. The annual rent will be trifling.

BUSINESS NOTICES.

The Pocket Battery.—Meadowcroft & Guyon, 65 Fifth avenue, New York City, manufacture a pocket battery for use with electric scarf-pins, which will be found very convenient. Any one who wishes to buy the latest novelty, will do well to send to the above firm, who will forward the battery, lamp, bottle, etc., for $7.50.

Miniature Electric Lamps.—Stout, Meadowcroft & Co., 21 Ann street, New York, are agents for the sale of miniature Edison lamps. These ingenious little lamps are intended for household, experimental and ornamental purposes, with the Meadowcroft & Guyon pocket battery. The lamps are of ½, 1, 2, 3, 4 and 6 candle-power, and special dental and surgical lamps can be had. The battery can be comfortably stowed away in the pocket and the lamp adjusted in the necktie, or on the hat or wherever required. Sold all complete, $7.50. There should be a large sale for these cheap and excellent novelties.

Harden Hand-Grenade.—This means of extinguishing fires, though comparatively new, is already in the enjoyment of great popularity. By throwing one of the grenades upon it, a fire just starting, or having already gained headway, is at once put out by the liquid contents of the grenade, a gas being generated in which combustion cannot go on. A large number of these effective fire-fighters are in use in telegraph offices, electrical works, and all kinds of factories. The cost is a bagatelle, and the protection afforded, being promptly obtainable, is better than that given by an ordinary fire department. The experiments we have ourselves witnessed are most convincing as to the effectiveness of the grenade.

Electro-Medical Instruments.—"For many years, the electro-medical instruments manufactured by the Jerome Kidder Manufacturing Company, 820 Broadway, New York, have enjoyed an enviable reputation as being the best adapted to the uses for which they are intended of any made. Recently this company exhibited at the Electrical Expositions some new forms of apparatus which have excited universal admiration for compactness, neatness, and beautiful workmanship. We have used these instruments in our own practice, and can honestly say that, for ease of adjustment and fine gradation of current, they are without an equal. The tip battery is a happy conception, and removes the great source of inconvenience due to spilling of acid. Athough we heartily recommend these instruments to users of electricity, the wide reputation they have acquired is sufficient guarantee of their excellence."—*Hall's Journal of Health.*

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED JAN. 20, 1885.

Armature for Dynamo-Electric Machines; C. F. Brush, Cleveland, O..... 310,876

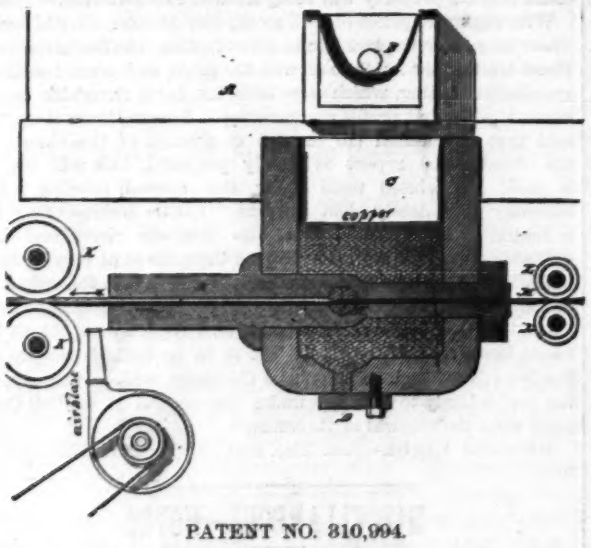
Consists in building up the armature-ring of alternating narrow and wide bands of iron, the wide bands being subsequently cut away to the width of the narrow band in the places where the bobbins are to be wound. The ring may be built up in several ways, but he prefers to form it by winding together into the form of a roll a wide and narrow band until sufficient convolutions have been formed to make up the desired thickness of the ring. It is evident, however, that the ring may be built up of short pieces held between the superposed convolutions of a longer band wound into the form of a roll; or the layers may be distinct concentric pieces held in place by rivets or the like. In any case a ring is formed of alternately wide and narrow layers, and the wide layers are afterward cut away to form the bobbin spaces, as described above.

Electrical Cable; Henry A. Clark, Boston, Mass.... 310,879

Consists of a central naked conducting-core, a series of independently insulated wires wound spirally therearound, a conducting-strip of foil or thin sheet metal applied thereover, and a braided or woven fibrous jacket inclosing and protecting the wires and foil, the inner core and the foil or sheet metal being adapted to be connected to the earth, substantially as described.

Electro-Magnetic Clutch for Step-by-Step Movements; William A. Rogers, Cambridge, Mass.. 310,913

Consists in what may be called a "magnetic clamp" or "locking device," the same consisting of one or more electro-magnets having their poles in contact with the member to be moved, but



PATENT NO. 310,994.

sliding freely over its surface, except when the said magnets are energized, when the attractive force will fasten together or unite the material of the magnet and of the member to be moved—which is, of course, of iron or magnetic material—causing it to move with the actuating device, or remain locked by means of a stationary magnet while the actuating device and magnets movable therewith are making their return movement, the stationary magnet being then energized, but the movable magnet not so.

Device for Securing Electric Wires to Poles; George L. Broomhall, Paterson, N. J..... 310,931

Consists of the plate *f*, having a screw pin *b*, on which is securable the cap *a*. The plate *f* is provided with hammer seats *d* and spikes *h*. These arrangements constitute modifications and improvements upon patents on the same subject granted to the same inventor.

Manufacture of Compounds to be Used for Insulating; Alexander Muirhead, Norwood, County of Surrey, England (patented in England)..... 310,957

Consists generally in the use of a purified mixture of paraffin wax or other hydro-carbons and gutta-percha, and particularly of the process which consists in dissolving out the raw gutta-percha in melted paraffin wax at a high temperature, then purifying the material so obtained, then mixing three parts thereof by weight with two parts of sulphurized oil, prepared by subjecting stearine to the action of chloride of sulphur, and then subjecting the mixture to a temperature of from 280° to 300° Fahrenheit for from two to three hours under pressure.

Telephone; Harry P. Pratt, Chicago, Ill., Assignor, by mesne assignments, to himself, Charles C. Bonney, John A. Hamlin and Charles E. Barrett, all of same place, and William R. Plum, Lombard, Ill., trustees... 310,961

He dispenses with the core of the helix.

Electric Railway System and Car; M. Holroyd Smith, Halifax, County of York, England (patented in England and France)..... 310,962

Consists of an electric railway system in which the car is supplied with an electric motor, wires, and a switch, and has mechanically and electrically combined therewith a trolley in an underground conduit containing insulated conductors, said trolley having contact-makers to transmit the current from the conductors to the motor, and said contact-makers being movable with relation to the trolley, and further automatically movable with relation to the conductors, so as to keep in contact therewith irrespective of the motion of the trolley, whereby the continuity of the current is secured and regulated.

Shuttle Operating Mechanism for Looms; Edward S. Winchester, Boston, Mass.....310,970

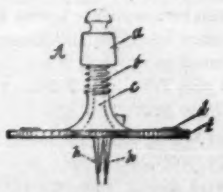
The object is to provide means whereby the shuttle of a loom may be driven to and fro in a rapid manner. It consists in a shuttle driver or picker combined with an electro-magnet and armature for imparting motion thereto, and automatic devices for opening and closing an electric circuit in which the magnet is mounted, whereby the attraction of the armature by the magnet si caused to actuate the shuttle-driver.

Apparatus and Process for the Manufacture of Compound Telegraph Wire; Moses G. Farmer, Newport, R. I.....310,993, 310,994, 310,995

Consists first in electroplating a steel or iron wire with copper and then in drawing the same through molten copper and shaping the wire by passage through a die. The wire passes into the molten metal through a hole of the size of the wire and issues through a hole of the size of the same wire plus the coating, and as it issues a blast of air is driven against it for the purpose of cooling the coating rapidly.

Secondary Battery; Salomon Kalischer, Berlin, Germany.....311,007, 311,008

One invention consists in the positive electrodes being made of iron, the negative being made of lead, and of an electrolyte being composed of lead salts, so that when the battery is charged a peroxide of lead coating is produced upon the positive electrode, and metallic lead is deposited upon the negative. In the other invention the positive electrode is made of pure or "naked" carbon.



PATENT NO. 310,931.

Burglar Alarm; Warner F. H. O'Keefe, Allegheny City, Pa..... 311,027

Relates to burglar alarms adapted to be operated by being trod upon. It consists in the combination, with spring-metal electrodes, of a yielding or elastic connection, the electrodes being oppositely bent to embrace a short rubber tube.

Automatic Cut-Out for Electric Lamps; William Hochhausen, New York, N. Y..... 311,072

He makes the action of the cut-out device positive and certain by causing its restoration to a normal condition by a positively acting device energized by the closing of the circuit through the carbons. The invention consists in employing a supplemental coil or magnet, the circuit through which is closed by contact of the carbons, and which acts in any suitable manner, either mechanically or electrically, to cause the cut-out device to break the cut-out circuit, so that the lamp may resume its operation.

Electric-Arc Lamp; William Hochhausen, New York, N. Y..... 311,073

Provides a focusing arc lamp suitable for locomotive head-lights. It consists in certain improvements in the mechanical devices supporting and actuating the carbon-carriers, and in the arrangement of magnets, motors, circuits, etc., whereby the proper movements of the carbon-carrier are secured. There are provided two screw-shafts, each carrying a nut for supporting or actuating a carbon, an electric-motor armature carried by one of said shafts, and two wheels gearing with one another, the wheel on one shaft having twice the circumference of that upon the other.

Focusing Electric-Arc Lamp; William Hochhausen, New York, N. Y..... 311,074

Relates to the construction of focusing electric-arc lamps, and is designed more especially to furnish a lamp adapted for use with reflectors upon steamboats or in other locations. Consists of the combination, with the two carbon-carriers, of the two pinions mounted concentrically, and having the carriers engaging on opposite sides, a retarding device geared to said pinions, and a movable support for the member of the gear-train which connects with the wheel for the pinion-shaft, whereby, when said support is moved under the action of a magnet and the gear-train is at the same time held from rotation, the pinion-shaft will be turned so as to cause the carbons to move in opposite directions and away from one another.

Socket for Incandescent Electric Lamps; Sigmund Bergmann, New York, N. Y., Assignor to Bergmann & Co., same place..... 311,100

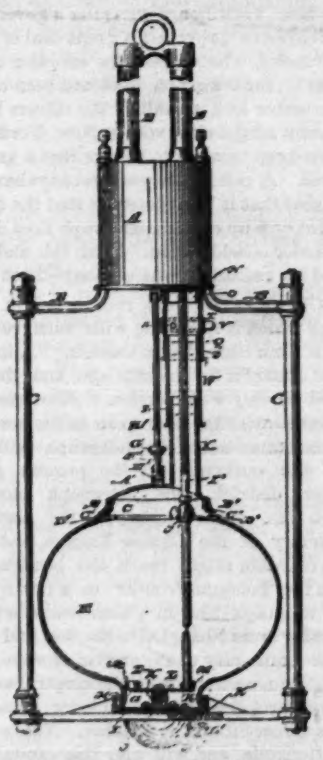
Relates to sockets for use with those incandescing electric lamps whose terminals are a screw-threaded ring and a plate on the base of the lamp, the lamp being screwed into the socket and making contact with corresponding terminals within the same; and it consists of the combination of two circuit terminals, one a sleeve adapted to make contact with the band or ring terminal, the other a spring movable into and out of contact with the bottom terminal of the lamp.

Lightning Conductor; Joseph R. Fricke, Pittsburgh, Pa..... 311,115

Consists of the combination of a flexible or cable conductor, supplied with a tube at its upper end, and of a rigid rod placed in the tube.

Connection for Electrical Conductors; Edward H. Johnson, New York, N. Y., Assignor to Bergmann & Co., same place..... 311,130

Consists in the connecting of two metallic parts of a circuit together by forcing a screw between them, such parts being held from lateral movement away from the screw, whereby the screw cuts into both parts and unites them firmly.



PATENT NO. 311,142.

Combined Gas and Electric-Light Fixture; P. H. Klein, Jr., New York, N. Y., Assignor to Bergmann & Co., same place..... 311,131

The invention is carried out by making the arm or arms for one lighting medium stationary, and arranging the arm or arms for the other medium, or a tip or tips thereon, for movement in a horizontal plane. The electric-lamp arms are preferably stationary, while the gas-arms have swiveled tips carrying burners, or the gas-arms themselves have a swiveled support and move in a horizontal plane.

Regulator for Dynamo-Electric Machine; Benjamin F. Orton, East Saginaw, Mich..... 311,141

Consists in arrangements whereby the number of coils on the two or more legs or cores of a field-magnet having a number of cores or legs may be simultaneously varied, so as not to disturb the symmetry of the magnetic field, while at the same time the strength of the field is varied.

Voltaic Arc Light; William P. Patton, Harrisburg, Pa., Assignor of one-half to W. E. Machlin, same place. 311,142

Consists of the feed-case *A* and a frame *C* which supports a globe *F*. The globe is made air-tight by a cover *A'* and telescopic joint *W* connecting with the feed-case. In the upper part of the telescopic joint is a perforation provided with an adjustable valve, and means are provided for admitting air automatically and intermittently into the globe.